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The Effects of Economic Reform and Foreign Direct Investment on the Domestic Economy and the Domestic Companies of Central and Eastern European Transition Countries

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by

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Voorwoord

Wanneer je aan mensen vertelt dat je beroep “onderzoek” is kijken ze eerst wat raar op. Wanneer je vervolgens zegt dat je aan de universiteit werkt, wordt je geassocieerd met drie maand vakantie in de zomer. Niets is minder waar. Een doctoraat neem je overal mee en blijft niet achter in een lade op het bureau. Soms is het het engeltje op de ene schouder, dan weer het duiveltje op de andere. Desalniettemin had ik het niet anders gewild.

Na het afstuderen in 1998 aan de Gentse Universiteit werd een klein roeibootje genaamd "licentiaat in de economische wetenschappen" in de Schelde te water gelaten om in oktober een 60-tal kilometer stroomafwaarts in die andere stad aan de Schelde weer opgevist te worden. Daar vond kapitein-van-vele-zeestormen Plasmans dat er toch beter een stevige motor in dat roeibootje geplaatst kon worden. Hij nam het kleine bootje op sleeptouw (tot in Santiago de Compostela) en stuurde het deeltijds naar de Leuvense haven. Na veel heen en weer geroei tussen Antwerpen en Leuven werd -mede dankzij de vakkundige steun van schipper Van Aarle van het LICOS- de "master of science in economics" te water gelaten. Na nog wat verder finetunen in de Antwerpse haven, begon de lokroep van de nieuwe havenmeester in de Gentse jachthaven, Schoors, steeds luider te weerklinken. Met als slogan "100% onderzoekstijd" en een knappe dame langs de kade, was de beslissing snel genomen -stroomopwaarts of niet-. Eens in de Gentse haven werd het motorbootje verder uitgebouwd (kwestie van ook een plaatsje voor de dame te voorzien) met behulp van de plaatselijke vaklui Everaert en Rayp. Voor de voorlopig laatste afwerking zorgden de internationale experten, Campos en Roland. Omdat er binnenkort alweer nood zal zijn aan een extra zitje, zullen dit waarschijnlijk niet de laatste aanpassingen geweest zijn. Dank aan Koen, Jef, Bas, Gerdie, Glenn, Nauro en Gérard voor de begeleiding en het deskundig advies.

"Onderzoek" betekent vaak ook terugvallen op de steun van administratief personeel, zonder hen zou het leven minder aangenaam zijn. Ook de vele aangename collega's-klankbord op het bureau en op de gang zijn een onmisbaar ingrediënt bij het urenlange nadenken en schrijven. Dank ook aan de vrienden uit Antwerpen, ik heb er veel geleerd en hun deur staat steeds open als ik er eens langsloop. Doctoreren betekent ook stukjes van de wereld ontdekken en nieuwe mensen leren kennen op congressen. Ook al worden taxi's soms duur betaald, is gefouilleerd worden door een militair geen sinecure, is het altijd nuttig het adres van het hotel mee te nemen, en is handbagage een *conditio sine qua non* voor de reizende researcher.

Vrienden en familie zorgden voor welkome afwisseling tussen de formules door. Tenslotte gaat ook een groot woord van dank naar mijn ouders voor de kansen die ze mij geboden hebben, zonder hen zou ik dit nu niet typen. Dank aan de knappe dame langs de kade, zij maakt alles de moeite waard.

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Niet-technische Nederlandse samenvatting

De val van het communisme op het einde van de vorige eeuw bracht een aantal belangrijke veranderingen van zowel sociale als geopolitieke aard teweeg. Het communistisch systeem had ook een belangrijk economisch luik waarbij de centrale overheid de rol van het marktmechanisme overnam. De val van het communisme betekende dan ook de start van een scala van institutionele en economische hervormingen zoals prijsliberalisatie, privatisering van staatsbedrijven, en het creëren van financiële markten. Algemeen werd verwacht dat na een initiële terugval bij de omschakeling van plan- naar markteconomie de implementatie van het marktmechanisme zeer snel zou resulteren in sterke economische groei. Deze hoge verwachtingen werden echter allesbehalve ingelost. Dit toont aan hoe onrealistisch de verwachtingen waren. De vier bijdrages in het doctoraat situeren zich binnen het kader van de transitie. De bevindingen overstijgen in vele gevallen echter dit kader en zijn relevant voor elk proces van grootschalige hervormingen of voor elk ontwikkelingsland.

In een eerste bijdrage analyseren we de relatie tussen economische groei en vooruitgang in hervormingen. Hervormingen hebben een negatieve impact op groei op het moment dat ze doorgevoerd worden, maar hebben nadien een positief effect dat het eerdere negatieve effect overtreft. Er is dus een aanpassingskost, maar deze wordt gecompenseerd door het latere positieve effect. In ongeveer de helft van de transitielanden zijn op een bepaald moment één of meerdere hervormingen teruggeschroefd. In de eerdere empirische literatuur had dit impliciet een positief effect op economische groei, wat indruist tegen de theoretische literatuur. Bijdrage één maakt gebruik van een nieuw empirisch kader en toont aan dat terugschroeven wel degelijk gepaard gaat met hoge kosten in termen van economische groei.

Het belang van de kosten verbonden aan het terugschroeven van hervormingen wordt behandeld in bijdrage twee. In de vele theoretische modellen die de ideale snelheid van hervormingen behandelen, spelen deze kosten een cruciale rol. Indien er geen kosten verbonden zijn aan het terugschroeven van hervormingen is het optimaal om meteen alle hervormingen uit te proberen (big bang). Indien er wel kosten zijn is het zaak om "foute" hervormingen te vermijden. Als er onzekerheid is over welke hervormingen de juiste zijn, neemt de kans op terugschroeven toe. Deze kosten, gecombineerd met onzekerheid, maken een stapsgewijze aanpak (gradualisme) interessanter. Een stapsgewijze aanpak heeft dan als voordeel dat ongepaste hervormingen tegen beperkte kost ongedaan gemaakt kunnen worden. Onze simulaties bevestigen de theoretische verwachting dat zelfs een relatief kleine kans op terugschroeven volstaat voor beleidsmakers om de stapsgewijze aanpak te verkiezen.

Aan grootschalige economische hervormingen en herstructurering zit ook een kostenplaatje vast. Omdat de binnenlandse financieringsbronnen beperkt zijn, is er nood aan externe middelen. Verschillende types financiële stromen brengen verschillende effecten teweeg. Vooral de mate waarin de financiële inbreng al dan niet gemakkelijk teruggetrokken kan worden is van belang. Vanuit dit oogpunt zal een gastland directe investeringen preferen boven andere kapitaalstromen. In bijdrage drie gaan we na welke factoren de aantrekkingkracht van een transitieland bepalen. We vinden dat zowel de meer vertrouwde factoren als marktgrootte, handelsintegratie, en loonkosten, als specifieke transitiefactoren zoals de snelheid van de hervormingen en de manier van privatiseren van voormalige staatsbedrijven een rol spelen.

Directe investeringen fungeren niet alleen als financieringsbron, maar ook als kanaal waarlangs binnenlandse ondernemingen met nieuwe technologieën en managementpraktijken in aanraking komen. Buitenlandse directe investeringen kunnen dus ook de economische groei en welvaart bevorderen. Hoewel dit adagium in beleidskringen algemeen aanvaard is, zijn de wetenschappelijke bewijzen ervoor beperkt. Door middel van een empirische analyse op bedrijfsniveau gaat bijdrage vier de effecten van de aanwezigheid van buitenlandse ondernemingen op de productiviteit van binnenlandse ondernemingen ('spillovers') na. Onze analyse probeert verschillende tekortkomingen uit eerdere literatuur weg te werken. Spillovers blijken veeleer een inter-sectorieel dan een intra-sectorieel gegeven zoals tot op heden werd aangenomen. Daarnaast tonen we

aan dat positieve spillovers voorwaardelijk zijn en wijzen we op het bestaan van belangrijke niet-lineariteiten.

General Introduction, Summary, and Conclusions

0.1 The setting

Probably the fall of the Berlin wall in 1989 is the most symbolic event that characterizes the end of the communist era. Historians even refer to "the short twentieth century" that starts with the murder on archduke Franz Ferdinand in 1914 and ends with the disintegration of the Eastern bloc and the destruction of the Iron Curtain (see Hobsbawm, 1994). The fall of communism brought along numerous important socio- and geopolitical changes. It implied the end of the cold war, the end of the CMEA, and the end of the Warsaw pact. Former Warsaw Pact countries joined the NATO, the Central European countries sought alliance with the European Union, *etc.*

The communist system also had an important economic component. The government was the administrator and the organizer of the economy, replacing the market as equilibrating mechanism. The failure of communism is partly due to its inability to keep up with the living standards of capitalist countries (see Estrin *et al.*, 2001). The fall of communism therefore kickstarted a transition from a planned economy to a market economy. This involves reform of numerous institutions such as price and trade liberalization, privatization of state-owned enterprises, the creation of financial markets, *etc.* (see Campos and Coricelli (2002) and Merlevede (2001) for a more detailed account). It was generally predicted that output and welfare would initially fall at the start of transition. It was also expected that the newly installed market mechanism would drastically improve the allocation of production factors and quickly boost economic growth after the initial drop in output. This has

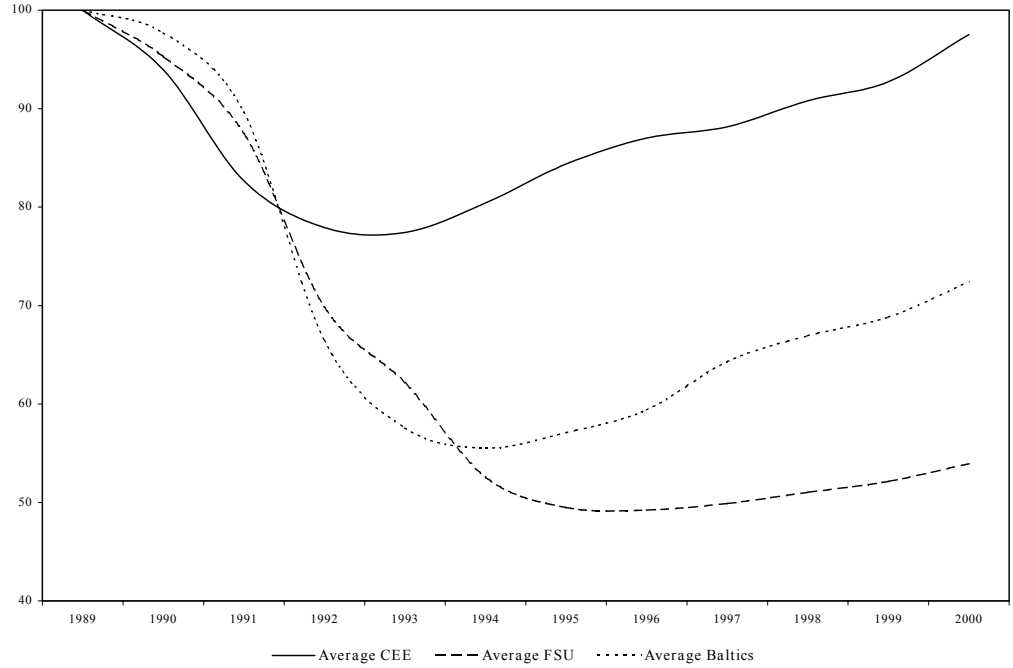

Figure 1: Real GDP paths in local currency - 1989 =100 (source: World Economic Outlook)

been referred to as the J-curve effect. In most countries however, the U-shaped output paths (see figure 1) did not live up to these high expectations. Stiglitz (1999) argues that these unrealistic expectations reveal just how poorly we understand the foundations of a market economy as well as the dynamics of institutional reform processes. The lessons of transition are thus important for economics as a science. Transition initiated theoretical research in search for a better understanding of the institutions that lie at the heart of the market economy. Because transition countries started from scratch in their transition to the market economy, they also make an ideal 'laboratory' to confront theory with empirical evidence. In the words of Kinoshita and Campos (2003):

> "*The transition to a market economy has been initiated more or less simultaneously in more than 25 countries that differ substantially in terms of inherited institutions, initial conditions, income levels and reform paths. This richness in variation allows comparative analysis in a unique situation akin to a natural experiment. In a large number of different dimensions the former centrally planned*

> *economies set out to implement economic and political reforms, applying different strategies and experiencing dramatically different outcomes*"

At the same time the economic profession at this side of the Iron Curtain was called upon for policy advice. A heated debate arose, and economists were divided in two broad streams of thought, namely shock therapists, who advocated radical reforms and rapid transformation, and gradualists, advocating a more cautious and piecemeal approach to reform. The proponents of a big bang strategy stressed the importance of using the window of opportunity to implement as much reform as possible and make use of the complementarity of reforms. An additional advantage, they argued, was that it would be more difficult to reverse those reforms. Those advocating a more gradual approach, on the other hand, stressed the need to build constituencies for further reform. By first implementing popular reforms, the public at large would be willing to accept more painful reforms afterwards. This then would give more legitimacy to the government for enacting further reforms. This is the background for the first chapters in this dissertation. In chapter one we analyse the relationship between growth and reform empirically.[1] We contribute to the literature by explicitly introducing the effect of reform reversals, i.e. a return in the direction of the centrally planned economy. Chapter two uses this empirical framework to investigate policy choice in the presence of reform reversals and aggregate uncertainty.

Such a process of large-scale economic reform and restructuring is costly and needs to be financed. As domestic sources for financing were limited, external financing was needed. Clearly, different types of capital flows entail different externalities and differ in terms of the degree to which they are subject to sudden reversal. In this respect the effects of foreign direct investment (FDI) are completely different from the effects of other sources of financing such as direct lending or portfolio investment. FDI is less reversible and in addition acts as a channel for the transmission of technology and managerial know-how. Therefore it can deliver a crucial contribution to foster economic development and welfare (Sinn and Weichenrieder, 1997). This provides the background

[1] Note that the traditional growth literature with a focus on long term growth and an underlying assumption of a market mechanism in place, is of little use in the transition context.

for chapters three and four. Chapter three provides an equilibrium analysis of the stock of FDI. In chapter four we investigate whether or not FDI acts as a channel for the transmission of technology and other know-how from foreign to domestic firms.

0.2 Growth, reform reversals, and policy choice

Chapters 1 and 2 deal with the empirical analysis of the interaction between reform and growth during transition, and the implications for policy choice. In chapter 1 we specifically contribute to the literature by analysing the impact of reform reversals during the transition from a planned to a market economy. Although theoretical work (*cf. infra*) attributes a crucial role to reversal costs in determining policy choice, this issue has been completely neglected by the earlier empirical literature. The debate on the choice of reform speed is the topic of chapter 2. We then employ our empirical results to analyse policy choice. The focus is on the role of reversal costs in determining the choice between gradualism and big bang. Below we provide a theoretical background on the importance of reversal costs in determining policy choice.

The large-scale reform process in the transition countries stressed the need to better understand the political economy of policy choice and yielded a number of models in this field. Fernandez and Rodrik (1991) discuss the implementation of large-scale reform when only the distribution of gains and losses from reform is uncertain. An individual therefore only finds out whether he is a winner or a looser once the reform has been implemented. Fernandez and Rodrik (1991) show that, in a dynamic setting, reforms with *ex ante* positive expected outcomes but *ex post* hurting the majority, can initially be accepted by the electorate only to be reversed in the next period provided the first period benefits exceed the reversal costs. Clearly if there were no reversal costs, all reforms with *ex ante* expected positive outcomes would be adopted. Higher reversal costs thus can -*ceteris paribus*- lead to the rejection of more reforms with *ex ante* expected positive outcomes, provided that there is uncertainty about the distribution. Rodrik (1995) builds a model of sectoral reallocation to analyse the dynamics of preferences over economic policy. The model is more closely tailored to transition than the one in Fernandez and Rodrik (1991). In the model reform is a decrease of the subsidy to workers

in the low-productivity state-sector that is financed by a tax on workers in the high productivity private-sector. Reform then allows faster development of the private sector. Rodrik (1995) shows that a reform[2], initially opposed by state-sector workers, may eventually gain support for continuation from these state-sector workers. In his model a vote between continuing the transition and returning to the status quo (a reversal), can only lead to a reversal in the early stages of transition. Whether a reversal actually occurs then depends on the way preferences are transformed into policy.

Our contributions in chapters 1 and 2 are most closely related to Dewatripont and Roland (1995). They illustrate the impact of reversal costs on the choice between a gradualist and a big bang approach to large scale institutional reform in the presence of aggregate uncertainty. Aggregate uncertainty can be thought of as simply reflecting the fact that a process of large-scale institutional reform involves coordination among different economic agents. This gives rise to multiple equilibria and it is not known in advance which equilibrium will eventually be selected. Given that our data in chapter 1 and 2 are macro-economic in nature and that we are unable to identify winners or losers, a model of aggregate uncertainty in a representative agent framework is appropriate. In the case of transition, uncertainty regarding the final outcome reflects that market economies are characterized by a set of core characteristics, but that many varieties exist. In this sense more reform is not always better if it is of the wrong type and a reversal is needed. We develop the model and illustrate the importance of reversal costs in more detail in section 0.2.1 below. The links with chapters 1 and 2 are discussed at the end of that section.

0.2.1 The importance of reversal costs: Dewatripont and Roland (1995)

We follow Dewatripont and Roland (1995) and consider a basic model with two reforms, $i = 1, 2$. The outcomes of both reforms are uncertain and depend on the respective realized states of nature $O_{1j}\,(j = 1, 2, ..., J)$ and $O_{2k}\,(k = 1, 2, ..., K)$. Implementing one reform ("partial reform") delivers a

[2]The reform is a decrease of the subsidy to state-sector workers in the low-productivity sector. This subsidy is financed by a tax on private-sector workers in the high productivity sector, therefore a reduction of the subsidy allows for faster development of the private sector.

net-present-value of $P(O_{im})$ for the representative agent. When both reforms have been implemented ("full reform"), the net-present-value for the representative agent is $F(O_{1j}, O_{2k})$, independent of the sequencing of reforms. For simplicity payoffs are assumed to be time-invariant. The time-invariant flow payoffs are given by $f(O_{1j}, O_{2k}) = (1-\delta) F(O_{1j}, O_{2k})$ and $p(O_{im}) = (1-\delta) P(O_{im})$.

Assume that observing $P(.)$ sheds some light on $F(.,.)$. In particular when implementing reform i, the resulting payoff $P(O_i)$ conveys a signal S_{in} that reveals some more information about the likely payoff from full reform. We can now rank the signals in terms of the expected payoffs of full reform conditional on the information content of the observed signal so that the expected payoff is increasing in n:

$$n > n' \Rightarrow \underset{j,k}{E}\left[F(O_{1j}, O_{2k}) | S_{in}\right] \geq \underset{j,k}{E}\left[F(O_{1j}, O_{2k}) | S_{in'}\right] \tag{1}$$

The model's baseline payoff is normalized to zero, and represents the evolution of the economy when the reform package under consideration is not implemented (another can). Inappropriate reform will result in $P(.)$ and $F(.,.)$ being negative. Reversing reforms can then be optimal. A reversal of the reform package brings the economy back at its baseline payoff. Call ξ_i the cost of reversing reform i -when it has been implemented alone- and experiencing the baseline afterwards[3]; and ξ the cost when both reforms have been implemented, where

$$0 < \max(\xi_1, \xi_2) < \xi < \xi_1 + \xi_2$$

This implies that reversing one reform is less costly than reversing both. Reversal costs are assumed to be borne by the representative agent. The idea of complementarity is captured by assuming $P(.) << F(.,.)$ and $P(O_{im}) < -\xi_i$. This makes partial reform never attractive *per se,* so that it is always followed either by a second reform or by a reversal to the default payoff. Including complementarity in the model clearly favours the big bang strategy and rules out that results depend on not including complementarity in the model. Figures 2 and 3 illustrate the big bang and the gradual approach to reform in this stylized model.

[3]Reversals costs are thus also defined in net-present value terms. Since the baseline payoff is normalized to zero, it is also the cost of reversing to the baseline.

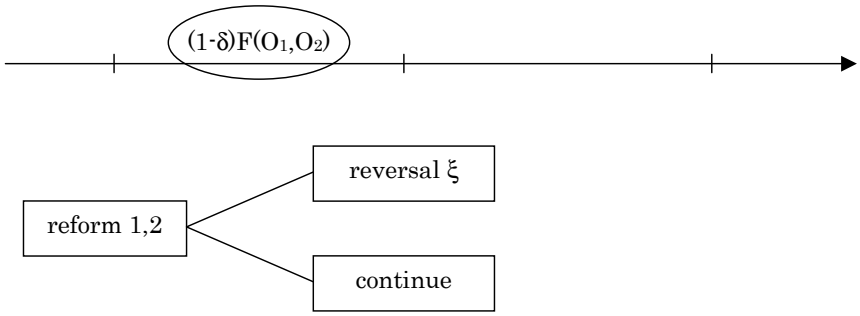

Figure 2: Big bang strategy

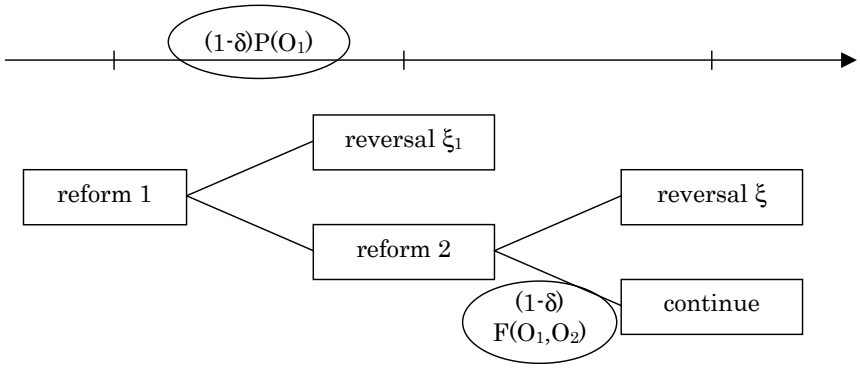

Figure 3: Gradualist strategy

A big bang strategy (BB) is defined as implementing both reforms simultaneously. The expected payoff is a combination of experiencing $F(O_{1j}, O_{2k})$ for one period and then deciding whether or not to continue the reform package. The latter decision boils down to a comparison of $F(O_{1j}, O_{2k})$ with $-\xi$,the cost of a reversal to the baseline.

$$BB = (1-\delta) \underset{j,k}{E} F(O_{1j}, O_{2k}) + \delta \underset{j,k}{E} \max\{-\xi, F(O_{1j}, O_{2k})\} \tag{2}$$

Figure 3 illustrates the strategy and sequencing under gradualism, call it GR_{12}. Gradualism implies trying reform 1 for one period. After learning $P(O_{1m})$ and observing signal S_{1n}, there can either be a reversal to the baseline at cost ξ_1 or a move to implement reform 2. Recall from the above that both these options dominate partial reform, i.e. implementing only reform 1. Once both reforms have been implemented the payoff of the full reform package is experienced for one period. At the end of the period the reform package can

be continued or reversed at cost ξ just as in the big bang case.

First focus on the last stage. After reform 1 has been implemented and signal S_{1n} has been learned, continuing with reform 2 has the following expected payoff

$$R_2(S_{1n}) = (1-\delta) \underset{j,k}{E} [F(O_{1j}, O_{2k}) | S_{1n}] + \delta \underset{j,k}{E} \max \{-\xi, F(O_{1j}, O_{2k}) | S_{1n}\} \quad (3)$$

where the full reform payoff is experienced for one period and where after that period a choice is made between continuing the full reform package or reversing both reforms and returning to the baseline.

In the first stage the expected payoff defined in (3) is to be compared with an immediate reversal of reform 1. Since the expectation of $F(.,.)$ is increasing in n (*cf.* (1)) it is possible to define $\widetilde{n}$ such that

$$R_2(S_{1n}) \geq -\xi_1 \text{ if and only if } n \geq \widetilde{n} \quad (4)$$

Early reversal thus only takes place when the signal is worse than $S_{1\widetilde{n}}$. The *ex ante* payoff of the gradualist package, GR_{12}, is then

$$GR_{12} = (1-\delta) \underset{j}{E} P(O_{1j}) + \delta \Pr(n < \widetilde{n})(-\xi_1) + \delta \Pr(n \geq \widetilde{n}) \underset{n \geq \widetilde{n}}{E} [R_2(S_{1n})] \quad (5)$$

If p_n represents the probability associated to a signal S_{1n}, with $n = 1, ..., \widetilde{n}, ..., N_i$, we have $\Pr(n < \widetilde{n}) \equiv \sum_{n=1}^{\widetilde{n}-1} p_n$ and $E_{n \geq \widetilde{n}} [R_2(S_{1n})] \equiv \sum_{n=\widetilde{n}}^{N_i} \frac{p_i}{p_{\widetilde{n}} + ... + p_{N_i}} R_2(S_{1n})$.

Note from (2) and (3) that we can write

$$BB = \Pr(n < \widetilde{n}) \underset{n < \widetilde{n}}{E} [R_2(S_{1n})] + \Pr(n \geq \widetilde{n}) \underset{n \geq \widetilde{n}}{E} [R_2(S_{1n})] \quad (6)$$

Rewriting and substituting $\Pr(n \geq \widetilde{n}) E_{n \geq \widetilde{n}} [R_2(S_{1n})]$ in (5) we have

$$GR_{12} = (1-\delta) \underset{j}{E} P(O_{1j}) + \delta BB + \delta \Pr(n < \widetilde{n}) \left(-\xi_1 - \underset{n < \widetilde{n}}{E} [R_2(S_{1n})] \right) \quad (7)$$

The first term on the right hand side of (7), $(1-\delta) E_j P(O_{1j})$, reflects a period of partial reform. This period can be costly in itself ($P(O_{1j}) < 0$) and is because of complementarities certainly worse than the first period of the BB-case (*cf.* (2)). The second term reflects the cost of delay in comparison to a big bang. Obviously delay is bad when $BB > 0$, but not so when $BB < 0$.

Finally, the third term reflects the option value of early reversal. The option of early reversal allows to save on costs when the prospects for further reform look disappointing. If $\widetilde{n}$ exists, $(-\xi_1 - E_{n<\widetilde{n}}[R_2(S_{1n})])$ is > 0. Indeed by definition of $\widetilde{n}$, $R_2(S_{1n}) < -\xi_1$ for $n < \widetilde{n}$. It is easy to see then that $E_{n<\widetilde{n}}[R_2(S_{1n})] < -\xi_1$. If $\Pr(n < \widetilde{n}) > 0$, the option value of early reversal will be positive.

Dewatripont and Roland (1995) show that for $F(.,.)$ and $P(.)$ given, if $\delta \to 1$, a necessary and sufficient condition for gradualism to dominate big bang is that the early reversal option is exercised with positive probability: $GR_{12} > BB$ if and only if $0 < \Pr(n < \widetilde{n}) < 1$. If instead $\delta < 1$, gradualism dominates if $0 < \Pr(n < \widetilde{n}) < 1$ and $E_j P(O_{1j})$ is not too negative.

The choice between the two strategies is still not univocal. It will also depend on the type of government. The above analysis relates to a benevolent social planner facing an optimal decision-making problem under uncertainty. Gradualism then makes reforms easier to start because it gives an additional option of early reversal at a lower cost after partial uncertainty resolution. It allows for a flexible approach and experimenting with smaller costs of trial and error.[4] A reform-minded government committed to reform for ideological or other reasons that faces constraints of political acceptability may still prefer a big bang. A big bang entails high reversal costs that constitute an advantage *ex post* because they reduces reversibility, thereby securing reforms. Clearly, from an *ex ante* point of view high reversal costs make a big bang approach infeasible in the light of the risk of a negative aggregate outcome.

What is now the importance of reversal costs? To investigate the issue assume that there are no reversal cost, that is $\xi = \xi_i = 0$. Replacing ξ with zero in (2), the expression for big bang becomes

$$BB = (1-\delta) \underset{j,k}{E} F(O_{1j}, O_{2k}) + \delta \underset{j,k}{E} \max\{0, F(O_{1j}, O_{2k})\} \tag{8}$$

which for $\delta \to 1$ is always ≥ 0. The same logic applies to the continuation

[4] The additional option of 'early' reversal under gradualism may, one could argue deter investment compared with the BB-approach, and early reversal may be the lack of investment response. However, the option value of waiting to invest is quite high, and investment response tends to be small in any case. Under those circumstances, Dewatripont and Roland (1995) show that GR may in fact generate more investment response before uncertainty resolution, thereby reducing *ex post* reversibility of enacted reforms.

payoff under gradualism

$$R_2(S_{1n}) = (1-\delta)\underset{j,k}{E}[F(O_{1j}, O_{2k})|S_{1n}] + \delta\underset{j,k}{E}\max\{0, F(O_{1j}, O_{2k})|S_{1n}\} \quad (9)$$

which for $\delta \to 1$ is also always ≥ 0. Because $R_2(S_{1n}) \geq 0$ and $-\xi_1 = 0$ (there are no reversal costs!), $\nexists \widetilde{n}$ with $n < \widetilde{n}$ for which $R_2(S_{1n}) < -\xi_1$. The result is that the option value of early reversal, $\delta \Pr(n < \widetilde{n})\{-\xi_1 - E_{n<\widetilde{n}}[R_2(S_{1n})]\}$ in (7), is always equal to zero. (7) then reduces to

$$GR_{12} = (1-\delta)\underset{j}{E}P(O_{1j}) + \delta BB \quad (10)$$

from which it is trivial to see that BB will always dominate since $BB \geq 0$ and $P(O_{ij}) < -\xi_i = 0$ because of complementarity. Intuitively, when there are no reversal costs, there are no costs of learning and experimenting, and thus never any advantage to early reversal.

Our empirical framework in chapter 1 is based on the standard in the literature and is only loosely related to the model. However, the idea of testing reversal costs is fully inspired by Dewatripont and Roland (1995) and attempts to bring empirics somewhat more in line with theory. The empirical framework relates yearly growth rates to new reform and the existing stock of reform and other variables. We think of the following mechanism that translates reform into growth ($\sim$ the welfare payoff). The closer a country comes to a market economy, the more benefits from better resource allocation and, hence, the higher the growth rate after an initial adjustment cost. While the theoretical model considers only two reforms, the empirical framework treats reform as a continuum between 1 (situation comparable to planned economy) and 4.3 (situation comparable to market economy). Different reform packages then give rise to a sequence of flow payoffs. It is as if the timelines in figures 2 and 3 are extend to more periods with multiple possibilities to reverse reform. In the empirical framework reform adds to the stock of reform and -after an initial adjustment cost- contributes positively to growth during the remainder of transition. Hence, a positive net present value of reform. Implementing the wrong reform is costly in the period it is implemented because of the adjustment cost and in the next period when it is reversed. A negative net present value results.

In chapter two we try to establish a tighter link between Dewatripont and Roland (1995) and our results. We think of a reform package as the entire transition process: a reform package that takes the economy from plan to market or in the empirical framework takes the average EBRD indicator from 1 to 4.3. A reform package then consists of numerous reform steps that can be implemented faster or slower.[5] Because various 'types' of a market economy exist there is still uncertainty about the type best fit for a particular country. Reversals did occur in reality, so uncertainty is present. Although only about 10% of our observations based on the average EBRD indicator is a reversal, reversals occurred in 12 out 25 countries or 48% of the countries. In a new dataset by Campos and Horvath (2005) there is not even a single country that did not experience a reversal! The *ex post* observed probability of a reversal during transition is thus very high and aggregate uncertainty as a key feature of transition is warranted. We simulate economic growth under different reform paths reflecting both the gradualist and big bang approaches to reform as they are commonly thought about. We create scenarios both with and without reversals and determine the probability a policymaker *ex ante* should attribute to a reversal in order to prefer gradualism over big bang.

0.2.2 Reversals and output growth

In chapter 1 we test whether reform reversals during transition carry an economic cost. Reform is measured by an average reform index, while reform reversals are characterized by a drop in the average reform index. In the standard empirical framework the level of reform, measured by RI, enters a growth equation in the following way: $\alpha RI_t + \beta RI_{t-1}$, where the expectation is that $\alpha<0$, $\beta>0$ and $|\alpha|<\beta$. The negative effect of current reform reflects an adjustment cost. The positive effect of lagged reform ('stock' effect) reflects idea that an economy closer to a market economy will benefit more from the market mechanism, in particular through better resource allocation. This leads to improved growth performance. It is expected that the stock effect will dominate if it has reached a sufficiently high level ($\sim |\alpha|<\beta$). Rewriting this expres-

[5] Admittedly, the entire transition may be more of a container ship of reform packages in different areas, but focussing on one indicator and the transition process as a whole allows for a clear account of the differences between gradualism and big bang. Moreover, most research and policy advice was/is in the framework of the entire transition process and arguments based on specific reforms are often carried through to the entire transition process.

sion as $\alpha\Delta RI_t + (\alpha + \beta) RI_{t-1}$, we observe that new reforms (ΔRI_t) carry an immediate cost in terms of growth but also a lagged positive effect through a higher level of reform (RI_{t-1}) that affects growth positively (recall that $|\alpha|<\beta$ is expected). However with $\alpha<0$ a reform reversal, defined as $\Delta RI_t<0$, generates an instantaneous positive growth effect in period t, slowing down growth only the following year because of the lower stock of reform (RI_{t-1} is ΔRI_t lower than in the no reversal case). Depending on the relative magnitude of α and $\alpha+\beta$, the cumulated effect of a reversal becomes negative only a few years after the reversal occurred. The non-linear effect of reform thus implies a counterintuitive, short-lived positive effect of a reversal. Therefore we explicitly introduce a reversal parameter in the empirical framework. Since policy choices result from a politically constrained process affected by economic variables, reform cannot be considered as a fully exogenous decision (Campos and Coricelli, 2002). Therefore we consider a simultaneous equation system where growth and the level of reform act as dependent variables and concurrently influence one another.

The results for the parameters taken from the standard framework confirm earlier findings. The positive stock effect dominates the adjustment cost. With respect to reversals, our results suggest that a reversal generates an immediate negative contribution to real output growth, contrary to the implied positive effect in the standard framework. The immediate contribution of a reversal of average magnitude to the growth rate is -2.65%-points. In the standard framework the same reversal increases the growth rate with 0.8%-points. Only two years later the lower stock of reform starts to dominate and the overall effect of the reversal becomes negative. Further tests suggest that a reversal is more harmful at higher levels of reform. A reform reversal of average magnitude at a high level of reform costs about 3%-points extra in growth terms compared to the same reversal at a low level of reform.

From the theoretical model above, we know that reversal costs are crucial for gradualist strategies to dominate big bang strategies in the presence of aggregate uncertainty. Our empirical framework implies that reversals are more costly under a big bang strategy than under gradualism, which boosts the case for gradualism. Comparing the limited impact of a reversal in the standard framework with our results, the strongly negative impact of a reversal strengthens the case for gradualism.

0.2.3 Reversals and policy choice

In chapter 2 our main interest is the relation between the choice of reform speed and economic growth and its effect on the policymaker's choice between gradualism and big bang. In comparison to chapter 1 we extend our system of equations for economic growth and economic reform with an extra equation for FDI inflows. The latter equation is a highly stylized model of FDI inflows. We find that new reforms affect economic growth negatively but that the level of past reform leads to higher growth and attracts FDI. FDI is also attracted by improvements in the growth rate, but with a lag. This means that the immediate adjustment cost of new reforms is counterbalanced by a future surge of FDI inflows and higher future growth through a higher stock of reform. The sum of these effects makes the result consistent with the results from chapter 1. Reform reversals result in lower growth rates. A further novelty is that, at the time of a reversal, we allow for an asymmetric effect of growth on reform. We cannot reject that in case of a reversal, growth does not influence reform.

We use the empirical results to simulate the impact of big bang and gradualist reform on economic growth, both with and without reversal in the reform process. Based on the simulations we can derive the optimal choice for a benevolent policymaker that maximizes long term economic welfare. If it is known whether a reversal will occur or not, the choice between big bang and gradualism is trivial for the benevolent policymaker: without a reform reversal, the big bang strategy will be applied, with a reversal, the gradualist strategy is preferred. We translate the concept of aggregate uncertainty into our framework as the probability that a reversal will occur. Aggregate uncertainty means that policymakers have imperfect information about the type of reform best fit for their country. Some reform steps may turn out to be inappropriate or inconsistent with other reforms. Reversals are then interpreted as a normal component of the trial and error process in search of the appropriate market economy model. If aggregate uncertainty is important, the probability of reversal will be high. Using the coefficients from the empirical model we calculate the minimum *ex ante* reversal probabilities that suffice to tilt the balance in favour of gradualism. We find that -given the complexity of the transition process- the case for gradualism is rather strong for the average transition country and it may take hard-nosed reformers to opt for a big bang strategy.

When we modify the policymaker's criterion from long term welfare to welfare within the standard political cycle, the case for gradualism is strengthened to such an extent that big bang strategies seem to belong to the realm of the unreal. However, differences in the level of economic welfare may be the wrong political criterion. Voters are unable to compare both strategies because only the outcome of the chosen strategy is observed. Because it is clearly observed, the turning point from negative to positive growth might be a better criterion for voter behaviour. This criterion does not bring good news for incumbent policymakers in an average transition country either. Gradualist policymakers are never re-elected and big bang policymakers only are able to maintain power when they gamble for a big bang without reversal. Therefore it should not come as a surprise that political instability has been a typical feature of transition, for the political fruits of economic reform may be bitter.

0.3 Foreign direct investment

Because of the optimism about the economic consequences of foreign investment, coupled with heightened awareness about the importance of new technologies for economic growth, many countries see attracting FDI as an important element in their strategy for economic development. What is more, in the case of transition countries FDI also provides external resources for financing the transition. This is far from luxury, given the limited domestic sources for financing. In this respect FDI has the additional advantage that it is probably the least reversible type of capital flows. FDI is also perceived as a catalyst for domestic development because it is an amalgamation of capital, technology, marketing, and management know-how that can spill over from foreign to domestic firms. Sinn and Weichenrieder (1997) call FDI "an indispensable ingredient in a successful strategy for economic growth and prosperity". It is therefore important for policymakers to know which factors attract FDI.

In chapter three we analyse the determinants of the level of bilateral FDI stocks held by the old EU-members in the ten accession countries, eight of which now have joined the EU. We present a partial adjustment approach to the equilibrium FDI stocks. Again, transition economies offer almost a natural control since FDI in the region was negligible prior to 1990. Furthermore, the impact of current policy variables is not obscured nor overcome by a long

history of past policies, for which it is difficult to control. Finally, in chapter 4 we perform a microeconometric analysis of FDI as a channel for the transmission of technology and other know-how from foreign to domestic firms. This complements the macroeconomic evidence of chapter 2, where we established a positive link between FDI inflows and economic growth for the average transition country.[6]

0.3.1 A partial adjustment model of FDI stocks

Chapter three presents a partial adjustment approach to FDI. In particular we focus on the bilateral FDI stocks of the old EU-members in the ten CEE-countries. Given the state of institutional and economic development, there is an equilibrium level of foreign involvement in an economy. The collapse of the central planning system initiated a flow of foreign investment to the CEECs. We think of FDI flows as an adjustment process towards the equilibrium level of the FDI stock. The observed FDI stock then reflects the impact of two driving forces. First, the stock is pulled towards its equilibrium level, even without policy changes. Second, during the course of transition the determinants of the equilibrium level of FDI have changed. As a result the equilibrium level itself has shifted over time. A partial stock adjustment model nicely encompasses these features and gives rise to a dynamic panel estimation.

We find that adjustment towards equilibrium is rapid. As equilibrium is quickly reached a focus on the determinants of the equilibrium FDI stock is warranted. We combine a group of traditional factors with a group of institutional factors induced by the transition process. With respect to the traditional determinants, market potential and trade integration with the source country are positively related to the equilibrium FDI stock. Higher relative unit labour costs vis-a-vis the source country are associated with a lower equilibrium level of foreign presence. Lower perceived riskiness is associated with more FDI. In the case of transition countries perceived riskiness to a large extent reflects progress in institutional development. We find that progress in almost all reform areas, as measured by the EBRD liberalization indicators, is associated with a better FDI record. Non-banking reform is the only exception. The rela-

[6] Note that in chapter 4 we limit our analysis to the spillover-effects from foreign to *domestic* firms only, while in chapter 2 the macroeconomic evidence does include the contribution of FDI-inflows to real GDP.

tionship between FDI and privatization is investigated more thoroughly. Our results suggests that current direct privatization has an immediate concurrent positive effect on the equilibrium level of FDI, whereas non-direct privatization schemes slow down adjustment to the equilibrium. Finally, privatization history positively affects the equilibrium level independently of the method applied.

0.3.2 FDI as a catalyst for domestic development?

During the last two decades, many emerging economies have dramatically reduced barriers to FDI, and countries at all levels of development have created a policy infrastructure to attract multinational firms. Standard tactics to promote FDI include the extension of tax holidays, exemptions from import duties, and the offer of direct subsidies. Since 1998, 103 countries have offered special tax concessions to foreign corporations that have set up production or administrative facilities within their border. (Hanson, 2001)

All these policy efforts build on the idea or rather the belief that technology and know-how will spill over from foreign to domestic firms. These strong beliefs are however in stark contrast with the sobering empirical evidence (Rodrik, 1999). Chapter four argues that previous research *i*) has been looking for spillovers in the wrong place; *ii*) to a large extent has neglected conditionalities; and *iii*) failed to take into account interactions and non-linearities. We extend the analysis beyond effects operating within industries to the effects operating across industries for the most important spillovers may run across sectors. Foreign firms not only compete with local firms in the same sector, but also interact with local firms that are upstream or downstream in the production chain. We identify backward spillovers (originating from contacts between a foreign firm and its upstream local suppliers) and forward spillovers (originating from contacts between a foreign firm and its downstream local buyer of inputs). We consistently find that intersectoral spillovers are economically much larger than sectoral spillovers.

Recently the literature has come to the understanding that the existence, direction and magnitude of spillovers may depend on sectoral, regional and firm-specific characteristics. If this is true, aggregate studies are bound to find insignificant or biased results. This leads us to focus on characteristics that make domestic firms sensitive to spillovers. We consider absorptive capability,

openness, sectoral competition and concentration, majority versus minority foreign ownership, and firm size. Rather than considering them in isolation we analyse possible interactions and non-linearities. Our results suggests that spillovers must be studied between sectors, taking into account non-linearities, interactions, and conditionalities The debate in the literature on the direction and magnitude of spillovers from foreign firms to local firms therefore has only one good answer: it all depends. Reassuringly we find that it depends in a way that makes economic sense.

0.4 Lessons learned

What can we learn from our results?

Benevolent social planners that are interested in maximizing welfare when they are confronted with large scale institutional reforms, are advised to opt for a gradual approach. Because large scale institutional reforms typically come with uncertainty surrounding the reform steps best fit for a particular situation, policymakers are faced with a high probability of making mistakes. We show that in such cases a gradual approach is best from a welfare point of view. The basic intuition is simple: if you don't know which way to run, it may be wise to walk in order to limit the cost of having to return on your steps.

Policymakers, however, are also concerned with maintaining power and thus face political constraints. The message from our research is sobering for big bang enthusiasts. The *ex ante* case for gradualism, on the other hand, is extremely strong when we focus on welfare effects delivered within the standard political cycle of four years. *Ex post* one may argue that it has become clear whether a reversal occurred or not. If not, one may argue that gradualism will turn out to be the wrong choice. However, taking into account confidence intervals it is not possible to discriminate between both strategies in the first four years, so choosing a big bang will not automatically guarantee better results within the standard political framework. This is due to the fact that early in transition a big bang entails important adjustment costs. In case of a reversal welfare will be considerably lower under the big bang strategy. Because voters lack the information to judge the policymaker based on economic welfare, they can focus on the switch from negative to positive real

GDP growth, which is observable. Policymakers that care about re-election will then gamble for a big bang and hope to stay clear from reversals. This is their only chance to maintain power because this strategy has a high likelihood of delivering positive growth rates within the standard political cycle of four years if no reversal occurs. Unfortunately, this turning point criterion does not imply welfare maximisation. From a welfare point of view the big bang gamble is a dangerous strategy, because if a reversal urges itself, the result will be devastating. Politics and welfare could be reconciled when the policymaker would be able to convey to voters the welfare implications of alternative policy choices.

Our second set of results implies some conclusions with respect to FDI policy. From the results in chapter two we know that FDI contributes positively to GDP growth which suggest to tailor policies to attract as much as FDI as possible. The results in chapter four warrant this optimism based on aggregate data. First, foreign firms are probably more productive and contribute to higher growth rates. It is not clear, however, whether the host country gains much by it, because foreign firms may repatriate the bulk of their profits. Whether or not domestic firms benefit from positive spillovers, depends on their characteristics. It depends on their position in the production chain: we find that foreign investment in sectors where local firms source their inputs yield the highest positive effects. It also depends on their absorptive capability, the competition they face in their sector, the competition from imports, and the presence on export markets. This suggests that it is important to 'prepare' domestic firms for foreign entry and enable them to capture positive spillovers. It might be argued that the fact that domestic firms that cannot cope with foreign entry are driven out of the market is not necessarily bad. Indeed, foreign entry can initiate a process of creative destruction. The question then is whether it is optimal to achieve this by competition from multinationals? In our view it is not. The suggested preparation stage for domestic firms can achieve this and may bring more domestic firms to a level allowing them to cope successfully with foreign entry. As such a complete wipeout of the domestic firms is prevented. Foreign investment after the preparation stage then allows domestic firms to further lift their performance.

How then to attract foreign investment? Overall our results suggest that in the end it all boils down to sound policies. By policies, we mean both macro-

economic policies aimed at stabilisation and long term growth, and reform policy in the transformation from a planned to a market economy. We found that foreign investment on the one hand reacts to the traditional determinants such as market size, labour costs and quality, trade integration, and riskiness. On the other hand foreign investment also reacts to a set of institutional determinants specific to the transition process. From chapters one and two we also know that institutional progress positively affects market size, so both sets are intertwined. Therefore a successful strategy for attracting FDI boils down to sound policies at all levels and in all reform areas.

The implications of our results on the effects privatization schemes on FDI deserve some special attention. In the long run the specific privatization method applied is of less importance because it is often only a first step in a series of ownership changes, allowing foreigners to participate sooner or later.[7] Obviously in the short run, some methods are more inviting to foreign investors than others. We find that direct sales (the state-owned firm is sold to the highest bidder) have an immediate positive impact on foreign investment. Non-direct methods do not decrease the equilibrium stock of FDI, but rather serve as a signal that makes potential investors postpone their transaction and slows down adjustment to the equilibrium FDI stock. As a consequence, direct sales are preferred from a short-run FDI perspective if they are fair and open.

Finally, throughout our work we find important effects of institutional development and indications that progress in all reform areas is required for durable welfare effects. This confronts the so-called Washington consensus that reflects the policy recipe adhered by the IMF, the World Bank, and other institutions alike when their expertise was/is called upon. The consensus implies swift reform with stabilisation and liberalization as key terms. The Washington consensus passes over the need for adequate underlying or accompanying institutional development. For example, the advice to privatize former state-owned enterprises should be accompanied by the advice to install a sound competition policy. Otherwise former state monopolies merely transform into private monopolies. Hardening the budget constraint requires a bankruptcy law, but one must be able to enforce the law as well.

[7] It has been shown that ownership is what ultimately matters for firm performance.

0.5 Further research

In chapters 1 and 2 we use an average indicator of reform because we are mainly interested in the choice of reform speed. The use of a single indicator allows for a clear and easy to interpret analysis of the optimal reform speed. A lot of research and policy advice has been based on single indicators and arguments based on specific reforms have often been carried through to the transition process as a whole. Staehr (2003) performs a principal component analysis of the individual EBRD indicators and finds that the first principal component (PC1) explains about 80% of the total variation. All the individual indicators have about equal positive loadings (between 0.32 and 0.37) on this component. Therefore our average indicator is likely to do a good job in capturing total reform efforts. In the words of Staehr (2003):"*PC1 captures 79.5% of total variation in the initial eight reform variables and, hence, it is not without merit that many studies use an overall reform variable simply calculated as the sum of the EBRD reform indices.*" Nevertheless, a disaggregated analysis with individual reform indicators would be a valuable exercise. Especially in the light of a new dataset developed by Campos and Horvath (2005) that became recently available. They construct objective indicators of privatization, internal, and external liberalization. The correlation between these subindicators is positive, but far from one. The correlation coefficient of internal and external liberalization is 0.48, the coefficient of internal liberalization and privatization is only 0.39, and the correlation between external liberalization and privatization is 0.66. Given these figures, a disaggregated analysis is certainly worthwhile.

Our results demonstrate the importance to think about reversals and to take them into account. A detailed study of the causes of reversals is left for further research. Since theoretical models as well as our own results point to the interaction of reform and politics, a good starting point can be an analysis of the political situation at the time of the reversal. Tommasi and Velasco (1996) give some descriptive evidence of the impact of election outcomes on the subsequent reform strategy. For a sample of 16 highly studied reforming countries (including three CEE countries) they report election outcomes and their impact upon the reform process. In only one out of the sixteen countries reforms were reversed by the new government, in a small share of countries

a change in political circumstances led to a slowdown in reform and in several countries reforms were continued even after the opposition to the initial reforming government came to power. Their starting point, however, is an election outcome, whereas the reversals themselves rather should be taken as starting point in our case.

Our partial adjustment approach to the equilibrium stock of FDI in chapter 3 does not allow for agglomeration effects. It is not unimaginable that FDI attracts further FDI. Theories of economic geography that suggest that firms are drawn to the same locations because of positive externalities or 'agglomeration effects' (see e.g. Krugman, 1991). Agglomeration economies are said to emerge when new investors mimic past investment in choosing a location in order to exploit positive externalities. Earlier investment may serve as a signal of favourable conditions and reduces uncertainty. More importantly the market potential of a specific location increases with the number of (foreign) firms locating there. By locating close to other firms, new firms locate close to their market since some other firms may require their products and the workers of the other firms will buy their products. This obviously suggests the use of regional data rather than country level data for testing the agglomeration effect. Barrel and Pain (1999) show that even only temporary differences in national or regional characteristics can have permanent effects on the location of activities. A strategic asset motive further adds to the agglomeration effect. Since firms cannot take the risk of not being present in a specific location when their competitors are they will also invest in that location. Other possible spillovers include technology spillovers and the availability of inputs and specialized labour (*cf.* chapter 4). An agglomeration effect would reveal itself in our approach through its impact on equilibrium FDI. Today's equilibrium stock of FDI should then depend on yesterday's stock of FDI. Temporary differences would then have permanent effects. In order to perform such a test we need to apply an unobserved component model for FDI.

The first sections of chapter 4 suggests that results for spillovers from foreign firms may differ across countries. A straightforward extension of our analysis is therefore to analyse other countries in order to compare results. An interesting question in this respect is whether there are systematic differences along the level of development of a country. There are also some more fundamental questions that still need to be addressed in the literature. First, the dynamic

aspects of spillover effects deserve some further research. The effect of a multinational entrant will probably not last forever, as well as the effect might not manifest itself immediately, but only with some lag. A more detailed dataset that includes the linkages firm by firm rather than the sector by sector approach based on input-output tables would be welcomed by the literature. We assume equality of spillovers from all upstream and downstream sectors, but is this assumption warranted? Finally, a related but equally important research question is whether firms from developing countries become multinationals to absorb technology in developed countries. And in the same line of thought: Do multinationals repatriate 'knowledge' from their subsidiaries to their home country?

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Chapter 1

Reform Reversals and Output Growth in Transition Countries[1]

In this chapter we test whether reform reversals during transition carry an economic cost. Reform is measured by an average reform index, while reform reversals are characterized by a drop in the average reform index. In the standard empirical framework the current level of reform affects growth negatively, while the lagged level affects growth positively. We show that this non-linear effect implies a counter-intuitive, short-lived positive effect of a reversal. In a simultaneous equation system with growth and the level of reform as dependent variables we explicitly introduce a reversal parameter. Empirical results suggest that reversals have an immediate negative impact on real output growth. Controlling for the level of reform shows that reversals are more costly at higher levels of reform.

[1] An adapted version of this chapter appeared in *Economics of Transition, vol. 11(4), pp. 649-69.*

1.1 Introduction

Since the start of the reform process in the early 1990s, economic performance has varied widely among the countries of Central and Eastern Europe (CEE), the Baltic States and the other countries of the Former Soviet Union (FSU). It was generally predicted that output would initially fall at the start of transition. It was also expected that the newly installed market mechanism would drastically improve the allocation of production factors and quickly boost economic growth. In most countries however, the U-shaped output paths did not live up to the high expectations. Stiglitz (1999) argues that these unrealistic expectations reveal just how poorly we understand the foundations of a market economy as well as the dynamics of institutional reform processes.

Several empirical studies have analysed the variation in economic performance. Most studies conclude that three categories of explanatory variables account for most of the cross-country variation in output paths, namely macroeconomic stabilisation, initial conditions, and structural reform. This paper adds to this literature by analysing the effect of reform reversals. Reform reversals are measured by a drop in an average reform index (RI). This reform index is calculated as a weighted average of the levels of the transition indices developed by the European Bank for Reconstruction and Development (EBRD). The level of the index reflects the average policy stance with respect to price liberalization, trade and foreign exchange liberalization, privatization, restructuring and financial market reform. In a sample of 237 observations there are 21 reversals. The non-linear effect of reform found in the standard empirical framework implies that -*ceteris paribus*- a reversal is associated with a short-lived positive effect. Only two to three years after the reversal its cumulative contribution to growth becomes negative. This empirical implication is in stark contrast with economic intuition.

In the theoretical literature reversal costs are attributed an important role in several models. The presence of a negative net present value of a reversal is crucial for gradualist strategies to be preferred over big bang strategies when aggregate uncertainty is taken seriously (Roland, 2000). Should there be no reversal costs, big bang strategies will always be optimal because there are no costs of learning and thus never an advantage to early reversal.

We think that this contradiction is due to the fact that the empirical lit-

erature fails to consider reversals. In this paper we test explicitly whether reversals have an immediate negative impact on real output growth.[2] We do this by estimating a system that includes the impact of reversals. The system's specification, with real output growth and reform as endogenous variables, is comparable to specifications found in recent literature (see e.g. Falcetti *et al.*, 2002). We find that reversals have an immediate negative impact on real output growth, while earlier findings with respect to initial conditions, stabilisation, and the non-linear effect of reform are confirmed. The impact of the average reversal on economic growth amounts to 2.65%-points in lost growth. Further results suggest that reversals are more costly in terms of lost growth at higher levels of reform. Reversals at high levels of reform cost 3%-points more in terms of lost growth than reversals at low levels of reform.

The chapter is organized as follows. In section 1.2 we review the relevant theoretical literature. Section 1.3 discusses the empirical literature and shows that in the standard empirical framework a reversal results in an insignificant effect or even a short-lived positive effect. Section 1.4 describes the data and presents the empirical framework. Section 1.5 presents empirical results and interprets the implied effect of reversals on growth. Finally, section 1.6 concludes.

1.2 Reform and Reform Reversals in the Theoretical Literature

The large-scale reform process in the transition countries stressed the need to better understand the political economy of policy choice and yielded a number of models in this field. Rodrik (1995) builds a model of sectoral reallocation to analyse the dynamics of preferences over economic policy. He shows that a reform[3], initially opposed by state-sector workers, may eventually gain support for continuation from these state-sector workers. In his model a vote between continuing the transition and returning to the status quo (a reversal), can only lead to a reversal in the early stages of transition. Whether a reversal actually

[2] Throughout the chapter the 'immediate' impact on real output growth is defined as the impact of a reversal in the same year as it occurs.

[3] The reform is a decrease of the subsidy to state-sector workers in the low-productivity sector financed by a tax on private-sector workers in the high productivity sector to allow faster development of the private sector.

occurs then depends on the way preferences are transformed into policy.

In the context of transition, there was consensus about the list of needed reforms[4], but the speed and sequencing of reform was heavily debated. Many transition policy models focus on the choice between gradualism and big bang. Transition as a process of large-scale reform does not only involve individual uncertainty, but also a great deal of aggregate uncertainty. It is far from clear whether the outcome of transition necessarily will be a copy of the West German miracle. In Dewatripont and Roland (1995) the role of reversals is based on the idea of aggregate uncertainty (*cf.* section 0.2.1). In their model, it can be beneficial to return to a conservative platform in case of a negative aggregate outcome of market-oriented reform. The cost of a reversal equals the expected pay-off of reversing the reform and returning to the conservative platform. Since reversing a big bang to the conservative platform requires a larger amount of reform to be undone, the reversal costs are higher than in the gradualist case. Comparing big bang and gradualist strategies, these high reversal costs are often considered an advantage *ex post* since they reduce reversibility. However, considering the possibility of a negative aggregate outcome may make the big bang strategy with its high reversal costs politically infeasible. Gradualism on the other hand makes it easier to start reform because the cost of reversing after partial uncertainty resolution is lower. In the presence of aggregate uncertainty gradualism allows a flexible approach to reforms with smaller costs of trial and error. Strong complementarities of reform may harden instead of weaken the case for gradualism, since they give scope for gradually building constituencies for further reform. Indeed, if initial reforms have been successful the electorate may be more willing to accept less popular reforms. More generally, Murrell (1992) makes an argument for gradualism in the spirit of evolutionary economics. The process rather than the destination is emphasized. Since there is little to say about the end point of transition, the focus should be on learning about possible outcomes through the transition strategy chosen. Roland (2000) develops different models of transition, incorporating political constraints, aggregate uncertainty and complementarities.

[4]The essential elements of the structural reform process are described in Kornai (1994): the move from a sellers' to a buyers' market by price liberalization and trade and foreign exchange liberalization, and the enforcement of a hard budget constraint by means of privatization, elimination of subsidy programs, and the creation and liberalization of a financial market; Blanchard (1997) adds restructuring within surviving firms and reallocation of resources from old to new activities to this list.

In these models the presence of reversal costs is crucial for gradualism to dominate a big bang strategy. Roland (2000) points to the crucial role of reversal costs as costs of learning to be weighted against the benefits of learning: "If reversal costs are important for large-scale experiments, uncertainty will lead to slowing down reform. Otherwise uncertainty can lead to accelerating it."

Note that aggregate uncertainty about the outcome of reforms is not a necessary condition to find reversals. Fernandez and Rodrik (1991) discuss the implementation of large-scale reform when only the distribution of gains and losses from reform is uncertain. In a dynamic setting, reforms with *ex ante* positive expected outcomes but *ex post* hurting the majority (uncertain distribution), are initially accepted by the electorate only to be reversed in the next period if the first period benefits exceed the reversal costs. Clearly if there were no reversal costs, all reforms with ex ante expected positive outcomes would be adopted. Higher reversal costs thus can -*ceteris paribus*- lead to the rejection of more reforms with ex ante expected positive outcomes, provided that there is uncertainty about the distribution.

1.3 Reform in the Empirical Literature

There is a vast amount of empirical work on the output performance of transition countries.[5] These studies focus on three categories of explanatory variables namely initial conditions, structural reform, and macroeconomic stabilisation. Macroeconomic stabilisation in the form of consumer price stabilisation, often achieved through an exchange rate peg or budgetary discipline, is found to be beneficial to economic growth (see De Melo *et al.*, 1996, Fischer *et al.*, 1996a,b, and Loungani and Sheets, 1997). Although initial conditions account to a substantial degree for the variation in economic performance at the start of transition, recent panel data studies conclude that their importance diminishes over time (see Berg *et al.,* 1999, and Falcetti *et al.,* 2002).

Concerning structural reform, De Melo *et al.* (1997) argue that the ability of transition countries to reallocate resources toward their best use and to establish institutions conducive to this reallocation has been a major de-

[5] See a.o. Åslund *et al.* (1996), De Melo *et al.* (1996), Fischer et al. (1996a,b), De Melo *et al.* (1997), Loungani and Sheets (1997), Krueger and Ciolko (1998), Berg *et al.* (1999), Heybey and Murrell (1999), Wolf (1999), Popov (2000), and Falcetti *et al.* (2002).

terminant of transition patterns. The idea is that the closer a country is to a market economy, the more it benefits from the market's growth generating allocational efficiency. The speed of reform was heavily debated. Some were proponents of a big-bang strategy (e.g. Sachs, 1993), while others advocated a more gradual approach (e.g. Dewatripont and Roland, 1992a, b). De Melo *et al.* (1996) constructed an aggregate reform index (RI) measuring reform achieved in different areas. Many studies analysed the impact of the cumulative reform index (CRI) on output growth, interpreting it as a measure for the speed of reform. Most of these studies find a significant positive impact of the CRI on economic growth, interpreting this as evidence in favour of a big bang strategy. Heybey and Murrell (1999) criticize the use and interpretation of the CRI as indicator of 'speed'. They define the speed of reform as the average growth in the *level* of the reform index (RI) since the start of transition. In their cross-section estimation the speed of reform has no significant impact. This reflects two opposing effects: the gains from liberalization of entry of new firms and the cost of dislocation in the existing state sector. They expect the former to start dominating the latter as transition progresses. This is in line with Berg *et al.* (1999) who show that a smaller negative impact of liberalization on state sector performance is offset by a larger positive impact on private sector growth.

Since policy choices result from a politically constrained process affected by economic variables, they cannot be considered as fully exogenous decisions (Campos and Coricelli, 2002). Clearly, the failure to take into account the feedback of growth to reform and the impact of initial conditions on reform will bias the estimated impact of reform on growth. To tackle this problem Wolf (1999) uses an instrumental variables approach. Heybey and Murrell (1999) propose to estimate a system with both growth and the speed of reform as endogenous variables. Falcetti *et al.* (2002) use a comparable system in a panel framework, but focus on growth and the level of reform as endogenous variables. The use of panel data also allows to test for dynamic effects of reform. Selowsky and Martin (1997) and De Melo *et al.* (1997) find a robust positive impact of lagged cumulated reform and a negative impact of the current cumulated reform, reflecting an adjustment cost. Wolf (1999) and Falcetti *et al.* (2002) find a significant impact of the lagged level of reform, while the impact of current reform is insignificant. In general terms, the level of reform,

measured by RI, enters a growth equation in the following way: $\alpha \mathrm{RI}_t + \beta \mathrm{RI}_{t-1}$, where the expectation is that $\alpha<0$, $\beta>0$ and $|\alpha|<\beta$. The negative effect of current reform reflects an adjustment cost. The positive effect of lagged reform ('stock' effect) reflects the idea that an economy closer to a market economy will benefit more from the market mechanism, in particular through better resource allocation. This leads to improved growth performance. It is expected that the stock effect will dominate if it has reached a sufficiently high level ($\sim |\alpha|<\beta$).[6] Rewriting this expression as $\alpha \Delta \mathrm{RI}_t + (\alpha+\beta)\mathrm{RI}_{t-1}$, we observe that new reforms ($\Delta \mathrm{RI}_t$) have an immediate cost in terms of growth but also a lagged positive effect through a higher level of reform (RI_{t-1}) that affects growth positively (recall that $|\alpha|<\beta$ is expected). However with $\alpha<0$ a reform reversal, defined as $\Delta \mathrm{RI}_t<0$, generates an instantaneous positive growth effect in period t, slowing down growth only the following year because of the lower stock of reform (RI_t will be $\Delta \mathrm{RI}_t$ lower than RI_{t-1}). Depending on the relative magnitude of α and $\alpha+\beta$, the overall or cumulated effect of a reversal becomes negative only a few years after the reversal occurred. Should α be insignificant, then there would be no effect on growth the year the reversal occurs. In the empirical part of this paper we explicitly address the case of a reform reversal in a system explaining growth and reform simultaneously.

1.4 Data and Empirical Framework

The usual caveats about data on transition countries apply. Especially early in transition the decline in output is believed to be overestimated. Since statistical systems were originally designed to collect information from state-owned enterprises they probably failed to capture large parts of the emerging private sector. Additionally, the use of pre-transition relative prices resulted in low weights for newly emerging activities (Berg *et al.,* 1999). Furthermore, both newly emerging activities and existing firms had an incentive to underreport output and sales to avoid taxes and regulation (Havrylyshyn *et al.,* 1998).

[6] Consider the following example to clarify this statement. Suppose α = -5 and β = 8. If the lagged level of reform is 1, while the current level is 2; then the contribution to growth of reform is -5*2 + 8*1 = -2. The overall contribution is thus negative. Now, should the lagged level of reform be 2, while the current level is 3; then the contribution to growth is -5*3 + 8*2 = +1. Hence the assertion that the stock effect dominates provided it has reached a sufficiently high level.

Studies such as Loungani and Sheets (1997) and Selowsky and Martin (1997) that use adjusted GDP data conclude that their results on growth determinants are not sensitive to the corrections to the data. Bearing these caveats in mind, we proceed using official data. Detailed data definitions and data sources are given in Appendix 1.A.

The aggregate reform index (RI) is constructed as a weighted average of eight transition indices as found in the EBRD's Transition Report. The indices can take values between 1 and 4.3 with steps of about $\frac{1}{3}$. A score of 4.3 is a situation comparable to a market economy; a value of 1 denotes a centrally planned system. These indicators reflect the progress of reform with respect to *i*) price liberalization (weight 0.3), *ii*) trade and foreign exchange liberalization (weight 0.3), and *iii*) privatization, restructuring and financial market reform (weight 0.4) (see also De Melo *et al.,* 1996). The former two are directly available from the EBRD Transition Report, the latter is the average of another six indices. A reversal is defined as a drop in the aggregate reform index, i.e. RI_t-RI_{t-1}<0. In our dataset covering about ten years of transition experience for 25 countries, there are 21 reversals in a sample of 237 observations. In about half of the countries considered at least one reversal took place during the course of transition up to now. Appendix 1.B provides more details on the indices and the reversals.

The EBRD transition indices are not perfect because they are subjective ratings. The ratings reflect the EBRD's assessment of both the effectiveness and extensiveness of policy measures, based on sometimes incomplete or imperfect information.[7] Moreover macroeconomic performance has often already been observed at the moment of assessment, which is a source of possible endogeneity. Campos and Horvath (2005) list four potential problems: i) outsiders do not know exactly the underlying variables, ii) outsiders do not know how the underlying variables transform into the indices, iii) the underlying variables consist of both policy inputs as well as outcomes, and iv) the indices have sometimes been revised without obvious changes in the underlying data. Until recently, no alternatives were available. However, Campos and Horvath (2005) made a major effort in establishing a rich dataset that allows them to compute more objective measures of reform that overcome some of the prob-

[7]See Annex 2.1 in the 2000 edition of the Transition Report for a detailed discussion of the issues related to the indicators, with special attention for the early period 1989-93.

lems of the EBRD indices. In appendix 1.C we reran the regressions presented in table 1.1 with the Campos-Horvath data. These regressions confirm our findings based on the EBRD-indicators.

All data were rearranged in 'transition timing'. In order to identify common elements across countries of the post-communist economic cycle, we have to take into account the cycle's different starting points. Transition year 1 (t) is then defined as the year in which communism and central planning were definitively abandoned. This is 1990 for Croatia, Hungary, FYR Macedonia, Poland and Slovenia; 1991 for Albania, Bulgaria, the Czech and Slovak Republic and Romania. For the Baltic States and the countries of the Former Soviet Union 1992 is taken to be the first year of transition.

Since both reforms and growth follow a clear time pattern, it is possible that the correlation between them is spurious. We control for the common time pattern by introducing a uniform quadratic time trend. Country specific effects are used rather than the initial condition clusters. The correlation between them is however fairly high (*cf. infra*). Time-varying effects of the initial conditions are accounted for, since their impact can be expected to decrease as transition progresses. We use the initial condition clusters of De Melo *et al.* (1997) who reduced a set of eleven conditions to two clusters by means of a principal component analysis. The first cluster (IC1) is interpreted as an index of macroeconomic distortions at the beginning of transition and unfamiliarity with a market environment, while the second cluster (IC2) is interpreted as an index of the level of socialist development and associated distortions prior to transition (IC2). The clusters express cross-country differences and the values of IC1 and IC2 do not have a direct interpretation. In general, the macroeconomic distortions were much larger in FSU-countries and the Baltic States than in CEE-countries. The picture on socialist development and associated distortions is less clear.

To deal with the endogeneity bias, we resort to a 3SLS estimation of the following system where growth and reform are jointly determined and affect one another. The framework is only loosely related to the model in Dewatripont and Roland (1995) (*cf.* section 0.2.1). However, the idea of testing reversal costs is fully inspired by their model and attempts to bring empirics more in line with theory.

$$\begin{aligned} \Delta GDP_{i,t} &= \alpha_0 + \alpha_i + \alpha_1 RI_{i,t} + \alpha_2 RI_{i,t-1} + \alpha_3 \Delta RI_{i,t} D_{i,t} \\ &\quad + \alpha_4 t + \alpha_5 t^2 + \alpha_6 tIC_1 + \alpha_7 tIC_2 + \alpha_8 STAB_{i,t} + \varepsilon_{i,t} \\ RI_{i,t} &= \beta_0 + \beta_i + \beta_1 \Delta GDP_{i,t} + \beta_2 \Delta GDP_{i,t-1} + \beta_3 FS_{i,t} \\ &\quad + \beta_4 tIC_1 + \beta_5 tIC_2 + \eta_{i,t} \end{aligned} \tag{1.1}$$

System (1.1) is closely related to the panel specification in Falcetti et al. (2002). If α_3 is set to zero, we obtain the 'standard' empirical framework. Real GDP-growth (domestic currency) is related to a constant, a country effect, a quadratic time trend, IC1 and IC2 multiplied by a linear time trend, a stabilisation variable, current and lagged reform and finally a reversal variable constructed as $\Delta \mathrm{RI}_{i,t} \mathrm{D}_{i,t}$. The dummy variable $\mathrm{D}_{i,t}$ takes the value 1 if a reversal occurs and 0 otherwise and $\Delta \mathrm{RI}_{i,t}$ is the change in the aggregate reform index, implying that the cost of a reversal in terms of lost growth is related to the reversal's magnitude. Next to having an effect by itself, the reversal variable corrects for the fact that part of the positive stock effect at the time of the reversal originates from an inappropriate reform. As stabilisation variable we choose the fiscal balance. Campos and Coricelli (2002) argue that inflation is rather a policy result, whereas the fiscal balance refers more to the policy itself. This is in line with Fischer *et al.* (1996b) who show that smaller fiscal deficits are especially important in reducing inflation. An empirical argument is given by Berg *et al.* (1999) who show that the fiscal balance is more difficult to reject than inflation in modelling transition countries' output paths. Falcetti *et al.* (2002) also use the fiscal balance as stabilisation proxy; the use of different stabilisation measures does not significantly affect results. The level of the reform index is specified as a function of a country specific effect, current and lagged real GDP growth, initial conditions interacted with a time trend, and the freedom status (FS). The freedom status is calculated as the average of the ratings on the Freedom House political liberties and the civil rights indices. The rating of the original indicators was inversed so that the value of our variable increases as political liberties and civil rights increase. Therefore we expect a positive value for β_3.

1.5 Results and interpretation

Table 1.1 presents the results of the 3SLS estimation of system (1.1). We treat GDP growth, reform and the measure of stabilisation as endogenous and use lagged values as instruments.[8] For instruments to be useful we require them to be correlated with the endogenous variables, but at the same time they should be uncorrelated with the error terms. At the bottom of table 1.1 we present the R^2 of the first stage regressions and an F test for joint significance of the included variables. Given the use of lagged values as instruments, we also specify for each equation a test for serial correlation. We present the familiar Durbin-Watson statistic, generalized to fixed effect model by Bhargava *et al.* (1982).

Specification [1] presents the estimates of (1.1) without reversals and will serve as a benchmark.[9] Results confirm the results of Falcetti *et al.* (2002), who use a closely related specification. The impact of the current level of reform is negative and insignificant, whereas the impact of lagged reform is positive and strongly significant. As measure of stabilisation the fiscal balance is correctly signed and significant. An improvement in the fiscal balance ('stabilisation') leads to a better growth performance. The common time pattern, identified by the quadratic time trend is also significant and accounts for part of the U-shape. Turning to the initial conditions, the level impact of IC1 and IC2 is reflected in the country specific effects. In particular the correlation of the country effects with IC1 in the real growth-equation is as high as -0.92, while the correlation with IC2 is only 0.10. Only IC1 has a significant time-varying impact. Since the values of IC1 range from -1.47 to +1.27 and larger values reflect worse initial conditions, the increasing impact over time indicates that countries with a worse starting position are catching up later (convergence effect). There is no evidence of a time-varying impact of IC2. Turning to the reform equation we observe a strongly significant positive impact of contemporaneous growth on the level of reform. The impact of lagged growth is negative but smaller in absolute value and not significant. With respect to the initial conditions, again

[8] Berg *et al.* (1999) use dates when agreements with the IMF on stabilisation programs have been concluded as instruments. They indicate that instrumenting makes little or no difference.

[9] In Merlevede (2000) we show that results are unaffected if subsamples of CEE countries, including the Baltic States, and FSU countries are considered.

	[1]	[2]	[3]	[4]	[5]
ΔGDP					
trend	3.202	4.014	4.035	5.228	3.744
	[2.16]	[2.09]	[2.21]	[2.40]	[2.13]
trend²	-0.128	-0.163	-0.168	-0.231	-0.151
	[-1.90]	[-1.92]	[-2.00]	[-2.23]	[-1.94]
trend*IC1	0.706	0.782	0.493	0.365	0.766
	[4.65]	[4.83]	[2.51]	[1.58]	[4.86]
trend*IC2	0.138	0.110	0.045	0.003	0.122
	[0.63]	[0.49]	[0.19]	[0.01]	[0.55]
RI	-5.139	-8.347	-14.239	-17.860	-7.460
	[-0.59]	[-0.77]	[-1.17]	[-1.40]	[-0.73]
RI(-1)	9.334	10.788	11.885	12.666	10.514
	[2.46]	[2.24]	[2.43]	[2.56]	[2.31]
reversal*ΔRI		25.470	32.239	37.593	
		[1.88]	[2.12]	[2.26]	
reversal* ΔRI* RI(-1)					7.982
					[1.97]
fiscal balance	0.231	0.223			0.221
	[2.46]	[2.30]			[2.35]
inflation			-3.449	-3.597	
			[-2.34]	[-2.43]	
inflation(-1)				-0.976	
				[-1.62]	
R-square	0.63	0.62	0.58	0.55	0.63
Chi-square	426.63	411.85	373.72	346.84	420.45
Panel-DW	1.88	1.92	1.91	1.96	1.91
RI					
trend*IC1	-0.034	-0.035	-0.035	-0.035	-0.035
	[-3.75]	[-3.78]	[-3.72]	[-3.64]	[-3.78]
trend*IC2	-0.012	-0.013	-0.013	-0.012	-0.013
	[-0.93]	[-0.96]	[-0.99]	[-0.93]	[-0.96]
ΔGDP	0.056	0.057	0.058	0.059	0.057
	[13.91]	[13.83]	[13.70]	[13.39]	[13.89]
ΔGDP(-1)	-0.003	-0.003	-0.005	-0.007	-0.003
	[-1.38]	[-1.34]	[-1.72]	[-2.06]	[-1.33]
freedom status	0.813	0.788	0.834	0.834	0.793
	[2.53]	[2.43]	[2.54]	[2.57]	[2.45]
R-square	0.72	0.71	0.70	0.69	0.71
Chi-square	770.15	764.45	739.14	712.53	766.94
Panel-DW	1.83	1.84	1.87	1.82	1.83
First stage regressions: R² / F test					
ΔGDP	0.63/11.0***	0.64/11.0***	0.64/11.0***	0.66/11.5***	0.64/10.9***
RI	0.95/117.4***	0.95/117.4***	0.95/117.4***	0.95/117.4***	0.95/114.8***
Stabilization	0.62/10.2***	0.62/10.2***	0.67/10.7***	0.67/12.3***	0.62/9.9***
N	237	237	237	236	237

Note. i) Fixed country effects are included in all regressions but not reported; ii)*Z*-statistics are reported in parentheses; iii) The Chi-square statistic indicates the overall significance of the model;

Table 1.1: Growth and reform determinants - 3SLS results

	r	*r+1*	*r+2*	*r+3*	*r+4*
reversal					
-0.025	0.13	0.02	-0.08	-0.19	-0.29
	-0.43	**-0.49**	**-0.55**	**-0.61**	**-0.67**
-0.050	0.26	0.05	-0.16	-0.37	-0.58
	-0.86	**-0.98**	**-1.10**	**-1.22**	**-1.34**
-0.100	0.51	0.09	-0.33	-0.74	-1.16
	-1.71	**-1.96**	**-2.20**	**-2.44**	**-2.69**
-0.155	0.80	0.15	-0.50	-1.15	-1.80
	-2.65	**-3.03**	**-3.41**	**-3.79**	**-4.17**
-0.300	1.54	0.28	-0.98	-2.23	-3.49
	-5.14	**-5.87**	**-6.60**	**-7.33**	**-8.07**
-0.700	3.60	0.66	-2.28	-5.21	-8.15
	-11.99	**-13.69**	**-15.40**	**-17.11**	**-18.82**

Table 1.2: Cumulated contribution to growth of a reversal based on the estimations without and with (bold figures) a reversal variable

only IC1 has a significant time-varying impact. The impact is negative in this case, implying a divergence between countries with good and bad (negative and positive) initial conditions. IC1 thus continues to influence growth negatively through its impact on reform, while the direct impact is diminishing over time. Finally the freedom status has the expected effect, i.e. countries with more civil liberties and political rights achieve a higher level of reform.

Specification [2] explicitly introduces the reversal concept. Coefficients are fairly stable both with respect to magnitude and statistical significance. The coefficients on current and lagged reform in the real growth equation increase somewhat in absolute value; current reform remains insignificant. The reversal parameter itself is positive and significant (z-statistic 1.88). Specifications [3] and [4] investigate the sensitivity of the estimates to the stabilisation proxy. Using inflation, or a combination of current and lagged inflation, results in a further increase in the absolute value of the coefficients on current and lagged reform, the reversal coefficient increases as well. The reversal coefficient is significant at the 5%-level.

Table 1.2 presents a first look at the reversal effect and gives an idea of how the impact of a reversal varies with different magnitudes of it. We perform a partial analysis here and focus solely on the ΔGDP-equation in (1.1). Simulations of the full system under different assumptions of policy speed and

reversal occurrence are analysed in chapter two in more detail. Row headings in table 1.2 then denote the magnitude of the reversal. Column headings list the 'reversal timing', with r the year of reversal. The table entries give the cumulative effect of a reversal up to n years after the reversal. This effect is calculated as follows. First current and lagged reform in the real growth equation of (1.1) are rewritten as $\alpha_1 \Delta \mathrm{RI}_{i,t} + (\alpha_1 + \alpha_2)\mathrm{RI}_{t-1} + \alpha_3 \Delta \mathrm{RI}_{i,t} \mathrm{D}_{RI,i,t}$. This allows the decomposition in an immediate impact $\alpha_1 \Delta \mathrm{RI}_{i,t} + \alpha_3 \Delta \mathrm{RI}_{i,t} \mathrm{D}_{RI,i,t}$, and an impact over time through the stock of reform $(\alpha_1 + \alpha_2)\mathrm{RI}_{i,t-1}$. This implicitly assumes that a reversal is 'lost forever', since in every future period the stock of reform would have been higher without the reversal of reform. The entries in table 1.2 are then calculated as $\alpha_1 \Delta \mathrm{RI}_t + \mathrm{n}(\alpha_1 + \alpha_2)\, \Delta \mathrm{RI}_t + \alpha_3 \Delta \mathrm{RI}_{i,t} \mathrm{D}_{RI,i,t}$ where n is the number of years since a reversal occurred[10]. The first line accompanying every reversal magnitude in the row headings in table 1.2 are based on the estimated parameters from the baseline specification [1], with α_3=0. Bold figures on the second line accompanying a reversal magnitude are based on the parameters from reversal specification [2] of table 1.1. The entries show contributions in %-points of a reversal to the real growth rate. In the baseline specification, a reversal is associated with a short-lived positive effect, lasting two periods. The average reversal of -0.155 increases the growth rate with 0.8%-points. From two years after the reversal $(r + 2)$ the lower stock of reform starts to dominate and the cumulative effect of the reversal becomes negative. In the reversal specification (the bold lines) reversals have an immediate negative impact in period r. The contribution of the average reversal of -0.155 to the growth rate is now -2.65%-points instead of +0.8%-points. The difference in the immediate impact of reversals on growth between the baseline specification and the reversal specification depends on the magnitude of the reversal and ranges from ± 0.5 to ± 15%-points. Since $\alpha_1 + \alpha_2$ in specification [1] exceeds $\alpha_1 + \alpha_2$ in specification [2], the cumulative effect of a reversal in the baseline specification will eventually catch up with the cumulative effect of a reversal in the reversal specification. This takes however fourteen years to happen. The main conclusion is that if reversals are explicitly included in the specification, they have an immediate negative impact on economic growth.

Column [5] in table 1.1 tests whether reversals are more costly in terms

[10] e.g. at $r + 2$, $n = 2$; at r, $n = 0$.

stock of reform	***1.50***	***2.00***	***2.50***	***3.00***	***3.50***	***4.00***
until r	*-0.70*	*-1.32*	*-1.94*	*-2.56*	*-3.17*	*-3.79*
until r+1	*-1.17*	*-1.79*	*-2.41*	*-3.03*	*-3.65*	*-4.27*
until r+2	*-1.65*	*-2.26*	*-2.88*	*-3.50*	*-4.12*	*-4.74*
until r+3	*-2.12*	*-2.74*	*-3.36*	*-3.97*	*-4.59*	*-5.21*
until r+4	*-2.59*	*-3.21*	*-3.83*	*-4.45*	*-5.07*	*-5.69*

Table 1.3: Cumulated contribution to growth of a reversal: effects of the attained stock of reform

of lost growth at higher levels of reform.[11] We test this by interacting the reversal dummy both with the magnitude of the reversal ($\Delta \mathrm{RI}_t$) and with the level of reform (RI_{t-1}). The coefficient on this variable is significant at the 5% level[12] and is correctly signed. All other coefficients remain stable. Table 1.3 shows how an average reversal of 0.155 affects real GDP growth at different levels of achieved reform. The assumed level of reform at the time of reversal is indicated in the column headings. Comparing the first and the last column, we see that a reversal at a reform level of 4.00 costs 3.1%-points more in terms of lost growth than at a reform level of 1.50.[13]

How do these empirical results relate to the theoretical discussion concerning the choice between gradualism and big bang in section 1.2? In terms of our empirical framework, this choice is determined by the comparison of their cumulative effects on real output growth. Roland (2000) indicates that the existence of reversal costs is crucial for gradualist strategies to dominate big bang strategies in the presence of aggregate uncertainty. In our framework transition is measured as the evolution of a reform index from 1 to 4.3. If there would be no uncertainty about the reforms, the first best is always to have a big bang, whether you include a reversal or not. Indeed an immediate maximal reform jump of 3.3 dominates all other transition paths with respect to real output growth, because this strategy maximizes the positive stock effect. Irrespective of whether one allows for reversals or not, a big bang is always better than gradualism. This holds for [1] to [5].[14]

[11] Negative confidence effects are likely to be larger in more advanced countries where more agents are more actively involved in the economy.

[12] Comparing results in [5] with those in [2] (both use the fiscal balance as proxy for stabilization), the z-statistic is considerably higher.

[13] As transition continues, this difference remains constant since in all cases the stock is 0.155 lower than it could have been.

[14] Note that in the absence of aggregate uncertainty, a reversal is unlikely to occur since the

However, if there is uncertainty the interpretation changes. Market economies are characterized by a set of core characteristics but many varieties exist. A score of 4.3 can be interpreted as 'a score equivalent to a market economy', but is does not tell you which market economy exactly. In this sense more reform is not always better if it is of the wrong type. This line of thought brings us closer to the interpretation of reform as finding out about possible alternatives. A reversal during the transition is then part of a trial and error process in the search for the most appropriate type of market economy. When we interpret the return to a conservative platform put forward in Dewatripont and Roland (1995) as a reversal to a specific level of the reform index, then the magnitude of the reversal and hence its cost will be larger under a big bang than under gradualism. Since a big bang strategy at a certain point in time is characterized by a higher stock of reform than a gradualist strategy, this is only reinforced by the finding in specification [5] that a reversal is more costly at higher levels of reform. In short, our analysis implies that reversals are more costly under a big bang strategy than under gradualism, which boosts the case for gradualism. Comparing the limited impact of a reversal in the standard framework with our results, the strongly negative impact of a reversal strengthens the case for gradualism.

1.6 Conclusions

Previous analysis showed that the evolution to a market system is one of the central elements in the transitional phase. The closer to a market system, the more beneficial effects on growth are expected. In the literature it is found that current reform affects growth negatively, while lagged reform affects growth positively and eventually dominates. We showed that the non-linear effect of reform in the standard empirical framework implies -*ceteris paribus*- that a reversal generates a short-lived positive, or at best an insignificant, contribution to growth. We think this may be due to the inadequacy of the standard empirical framework.

In our empirical framework we explicitly account for reform reversals in a

superior end point is known. Furthermore, since gains are probably high enough, possible losers can be compensated if there is individual uncertainty (cf. Fernandez and Rodrik (1991)). In this case, the big bang strategy has also the additional advantage that the high reversal costs make a reversal politically less feasible.

simultaneous equation system with real GDP growth and the level of reform as endogenous variables. Our sample contains 21 reversals upon 237 observations, pointing to the relevance of reversals during transition. Generally, earlier findings are confirmed. With respect to the reversal case, our results suggest that a reversal generates an immediate negative contribution to real output growth, contrary to the implied positive effect in the standard framework. The immediate contribution of a reversal of average magnitude to the growth rate is -2.65%-points. In the standard framework the same reversal increases the growth rate with 0.8%-points. Only two years later the lower stock of reform starts to dominate and the overall effect of the reversal becomes negative. Further tests suggest that a reversal is more harmful at higher levels of reform. A reform reversal of average magnitude at a high level of reform costs about 3%-points extra in growth terms compared to the same reversal at a low level of reform.

From a theoretical point of view, the importance of reversals lies in the existence of reversal costs. These costs are crucial for gradualist strategies to dominate big bang strategies in the presence of aggregate uncertainty. Our empirical framework implies that reversals are more costly under a big bang strategy than under gradualism, which boosts the case for gradualism. Comparing the limited impact of a reversal in the standard framework with our results, the strongly negative impact of a reversal strengthens the case for gradualism. In chapter two we continue with a more detailed analysis of the choice between big bang and gradualism in the light of our empirical findings.

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Appendix 1.A Variables description and data sources

	Description
ΔGDP	Real GDP growth, domestic currency, annual percentage change
FB	Fiscal balance, consolidated balance of general government, variable is negative if the balance is in deficit
INF	End year inflation, transformed as ln(1+(Inflation/100))
RI	Reform index, see paper/Appendix 1.B for construction
D	Reversal dummy =1 if RI_t-RI_{t-1}<0
$IC_{1,2}$	Initial condition clusters
FS	Freedom Status, average of political rights and civil liberties indexes; index ranges from 1 (free) to 7 (not free), original rating is inversed and rescaled (1=free; 0.14=not free) see also www.freedomhouse.org/research/freeworld/2000/methodology.htm

	Data Sources
ΔGDP	IMF, World Economic Outlook Database (October 2002)
FB	EBRD Transition Report
INF	EBRD Transition Report
RI	Own calculations based on indicators in EBRD Transition Report
D	idem
$IC_{1,2}$	De Melo et al. (1997)
FS	Freedom House

Appendix 1.B Reform reversals

A reversal is defined as a downgrading of a country's score on our reform indicator (RI_t-RI_{t-1}<0). Following De Melo *et al.* (1996) the reform indicator is constructed as a weighted average of three subindexes reflecting the progress of reform with respect to *i*) price liberalization (weight 0.3), *ii*) trade and foreign exchange liberalization (weight 0.3), and *iii*) privatisation, restructuring and financial market reform (weight 0.4). The former two are directly available from the EBRD Transition Report and the latter is the average of the following indices: small- and large-scale privatisation, enterprise reform, competition policy, banking sector reform, and reform of non-banking financial institutions. The EBRD reports scores for the single indices, which can take values between 1 and 4.3 with steps of about $\frac{1}{3}$. Our sample contains 21 reversals upon a total 237 observations. The value of a reversal varies between -0.02 and -0.70, the average magnitude is -0.155, and the median is -0.090. Our reversal definition implies that a reversal can be due to a reversal in one or more subcategories. It is also possible that a small reversal in one subcategory is compensated for by progress in other subcategories. The latter is the case in Azerbaijan (1999), Latvia (1997), Lithuania (1997), and Romania (1997).

Country	year	EBRD-index
Belarus	1996	large scale privatisation, banking sector reform
	1997	forex and trade liberalisation, enterprise reform
	1998	price liberalisation
	1999	price liberalisation
Bulgaria	1995	price liberalisation
Kazakhstan	1999	forex and trade liberalisation
Kyrgyzstan	1999	banking sector reform
Latvia	1998	banking sector reform
Romania	1996	forex and trade liberalisation
	1998	banking sector reform
Russia	1998	price liberalisation, forex and trade liberalisation,
		banking sector reform, non-banking fin. institutions
	1999	enterprise reform, banking sector reform
Slovak Republic	1997	forex and trade liberalisation, enterprise reform
Tajikistan	1993	price liberalisation
Turkmenistan	1998	large scale privatisation
	2000	enterprise reform
Ukraine	1998	forex and trade liberalisation
Uzbekistan	1997	price liberalisation, forex and trade liberalisation
	1998	price liberalisation
	1999	forex and trade liberalisation
	2000	enterprise reform

- Belarus 1996 - *index private entry in markets (large scale privatisation, banking sector reform)*

  Already in 1993 Belarus launched a privatisation program for large state-owned enterprises. In 1996 however, only 20% of the program's total number of enterprises had been 'transformed' into joint stock companies, in which the government initially owned 100% of the shares. Genuine privatisation with majority ownership and decision-making powers transferred to private investors had not really been taking place. The 1996 privatisation program stated that shares were to be sold to the population for vouchers that had been distributed in 1994. Early 1996 registration of enterprises was suspended, however, so that a change in the ownership structure could not be registered. This measure effectively suspended the privatisation process. Additionally new companies could also not be registered any longer.

  In 1996 the four largest banks were still controlled by the state. Although foreign and joint-venture banks were allowed to operate, the regulatory regime was not well defined and few foreign banks had applied for a licence. Bank supervision was also weak. In this context the government continued to intervene in the banking sector. In 1996 the National Bank of Belarus (NBB) and some commercial banks were requested to earmark credits to some sectors of the economy, in particular agriculture and housing. During this year directed credits provided to agriculture at half of the monthly refinance rate accounted for 77% of total directed credits.

- Belarus 1997 - *index of private entry in markets (enterprise reform) and index of trade and exchange rate regime*

  Progress with privatisation remained cumbersome (cf. 1996). Five large enterprises, explicitly targeted for privatisation in 1997, were not privatised. Successive annual privatisation programmes approved since 1993 had always fallen short of their targets. Most of the privatisations of large state-owned enterprises had been to management and employees. Majority ownership and the transfer of decision-making powers to private investors did not take place. The government intervened in firms' capital and investment decisions and in the setting of price and production targets. In 1997 the government borrowed BRB 500 billion from the NBB

to write off energy arrears accumulated by state-owned enterprises. Nevertheless, enterprise arrears to the budget increased in 1997, with profit tax arrears more than doubling during this year. Early 1998 commercial banks were ordered by the government to open a BRB 2 trillion subsidised credit line to agricultural enterprises on top of the allocation of BRB 0.5 trillion of soft credits.

In April 1996 the Minsk Interbank Currency Exchange (MICE) was nationalised and put under the direct control of the NBB. January 1997 a directive issued by the NBB limited purchases of hard currency and Russian roubles at the MICE. Furthermore the NBB reintroduced convertibility restrictions. Exporters were now required to surrender 40% of their foreign exchange earnings to the state at a highly overvalued exchange rate. During 1997 there was also a 107% increase in net domestic credit by the National Bank of Belarus. The currency corridor vis-à-vis the dollar (established in January 1996, since April 1996 the nominal exchange rate was allowed to depreciate within a pre-established band) had to abandoned in 1997. Additionally government efforts to maintain artificially low interest rates (interest rates in commercial banks were controlled by the government through the NBB) contributed to large capital flight to Russia, where interest rates were higher (in Belarus interest rates were negative in real terms).

- Belarus 1998 - *index of price liberalisation*

  Following the 1997 increase in domestic credit, the Belarussian rouble plunged by 30%in March 1998. Lacking adequate foreign reserves, the National Bank of Belarus was unable to stabilise the Belarussian rouble. This led the government to pursue a range of administrative interventions in the market (replacing existing informal price controls) to prevent further price increases (and further devaluation). The government ordered both public and private enterprises to return prices to their pre-crisis level and banned any further price increases above 2% a month. During 1998 numerous regulations and restrictions on currency trade were imposed and subsequently lifted at the discretion of the authorities, e.g. exporters required a special permit from the authorities for a number of goods, including some basic food and consumer products.

- Belarus 1999 - *index of price liberalisation*
  During 1999 price controls were further tightened in an attempt to curb still accelerating inflation. In May 1999 a presidential decree banned any price increase that was not compensated for by measures of social protection, and mandated the Council of Ministers and the NBB to set annual limits for price indices. The decree also re-introduced state price regulation for a wide range of goods and services, including products and services supplied by monopolies, rents and basic foods and spirits. The state thus continued to rely on price controls as means of limiting inflation and allocating resources. Although this resulted in a slow-down of inflation, inflation in Belarus remained the highest in all CIS countries, increasing far above the 2% monthly target.

- Bulgaria 1995 - *index of price liberalisation*
  After an initial sweeping liberalisation of prices in 1991 covering about 90% of the consumer basket, price controls were reintroduced. In 1995, prices covering only about 54% of the consumer basket were free of administrative controls. Fixed prices applied to energy products[15], post and telecom, and tobacco products, and ceiling prices to most fuels. The monitoring of profit margins of both producers and traders applied to goods declared to be of vital importance to the living standards of the population (this includes basic food products, passenger transportation and certain non-food products as e.g. pharmaceuticals). Most importantly, a Price Law was passed by parliament enabling the government to introduce (further) price controls at its own discretion. The administrative structure for price controls was strengthened further in a 1996 initiative envisaging local structures and a larger number of controllers (500 inspections in July 1996 alone).

- Kazakhstan 1999 - *index of trade and foreign exchange liberalisation*
  In early 1999 Kazakhstan imposed an import ban on selected Russian goods and 200% tariffs on similar items from Kyrgyzstan and Uzbekistan. Late 1999 the restrictions were lifted for the former two countries, whereas they remained in place for Uzbekistan. This backtracking in

[15] e.g. electricity prices remained among the lowest in the world, even after an increase of 25-38% in September 1995.

trade liberalisation created however tensions with neighbouring countries. The introduction of product norms, such as a dual Russian and Kazakh language label, are also considered an implicit trade barrier by importers. Additionally, as part of the April 1999 devaluation package, a 50% export surrender requirement was temporarily introduced (the requirement was lifted again end 1999).

- Kyrgyzstan 1999 - *index of private entry in markets (banking sector reform)*
  An exchange rate depreciation and bank failures led to the collapse of the fragile Kyrgyz financial system (a.o. due to weak bank supervision and under-capitalisation (e.g. very low minimum capital requirements)). Five of the largest banks were either placed under conservatorship by the central bank or were liquidated in the first half of 1999. Two more banks were added to this list later on. Several banks had a large exposure to the state gas company that was affected by a large-scale fraud at the beginning of 1999. The failure to recognise and to respond to this problem revealed the weak supervision capabilities of the Central Bank. As a result of the collapse of the financial system, access to new credit by the private sector became virtually non-existent. During 1999 the share of loans classified as substandard, doubtful or losses also rose from 7% to 25%.

- Latvia 1998 - *index of private entry in markets (banking sector reform)*
  The high Russian exposure of some Latvian banks led to sharp losses in the aftermath of the Russian crisis. Operations of two smaller banks were suspended, while the ninth largest bank went bankrupt. Early 1999 the operations of the Rigas Commercial Bank (the fifth largest bank) also were suspended and a court declared the bank insolvent. In March the third largest bank, Rigas Komercbanka, was declared insolvent and closed. In response to the crisis, the central bank strengthened regulatory requirements for banks (e.g. consolidated reporting, loan loss provisioning, and maximum permissible exposures to borrowers in non-OECD countries).

- Romania 1996 - *index of trade and foreign exchange liberalisation*
  Enterprises' access to foreign exchange became more restricted in 1996.

The lei, which was floating, had been officially convertible for the purpose of foreign trade transactions and for repatriation of capital and profits of foreign investors. In August 1994 an interbank foreign exchange market was launched. From July 1995 onwards, foreign banks with local branches were granted permission to operate as dealers on this market. Exposure was limited both for dealers and brokers. In an attempt to control the downward tendency of the lei the authorities started to impose increasingly tight restrictions on enterprises' access to conversion of lei into foreign currency and on the foreign currency operations of commercial banks in 1996. From March 1996 onwards only four banks could participate in the market; none of which was foreign and only one was not state-owned. In August, the government announced new surrender requirements for more than 100 firms; although these requirements were later given a more liberal interpretation in official announcements, the original decree remained in place.

- Romania 1998 - *index of private entry in markets (banking sector reform)*
  In 1998 the Romanian banking sector was still dominated by five large state-owned banks, accounting for about three quarters of total banking sector assets. These banks extended credit to loss-making state enterprises and thus accumulated large amounts of bad loans. Though the regulatory framework for bank supervision was improved with the adoption of three new laws in 1998, political interference constrained effective supervision. A decision by the central bank (NBR) to revoke two bank licences was overruled by the courts in December 1997. The NBR also took on its books five-year bonds worth about USD 1 billion, issued by the Ministry of Finance to cover bad debts of the two largest state-owned banks. This indicates the weak central bank independence and the use of inflationary bailout operations.

- Russia 1998 - *index of price liberalisation, index of trade and foreign exchange liberalisation, and index of private entry in markets*
  In 1998 Russia faced a severe currency crisis. On August 17 the rouble-dollar corridor was widened substantially and a 90-day moratorium on foreign debt service by domestic banks and enterprises was imposed. Shortly afterwards additional pressure forced the central bank (CBR) to

let the currency float beyond the new corridor. With surging prices and declining imports many regional governments introduced price controls (ranging from ceilings on profit margins to administered price-setting). To prevent food shortages restrictions were placed on the movement of selected locally products. Driven in part by budget revenue considerations export tariffs were reintroduced for oil, gas, metals, petrochemicals and some other goods. The foreign exchange liberalisation was reversed: a range of currency restrictions was introduced, leading to a serious decrease in the degree of convertibility of the rouble. The currency market became segmented with a de facto multiple exchange rate regime. The surrender requirement for exporters was raised from 50% to 75%, access of foreign banks to the foreign exchange market was limited and a deposit/advance payment system was introduced for import transactions.
A new bankruptcy law was enacted in March 1998. Though much improved, it was biased against private creditors, overemphasising restructuring at the expense of liquidation and it provided extensive rights to local authorities with respect to the bankruptcy procedure for large enterprises. Moreover effective implementation did not match the improvement in the legal framework, weakening the bankruptcy threat. By backtracking in a number of high-profile bankruptcy cases, the government showed a lack of political will to allow the market to select enterprises for survival.
Due to a weak regulatory structure commercial banks developed large foreign currency exposure. The currency crisis would have plunged nearly the entire banking system into insolvency if the government had not declared the moratorium. The crisis led to a run on the banks, a breakdown in the payments system, disruptions in tax collection and the collapse of financial intermediation. The initial response of the CBR exacerbated the problems through indiscriminate liquidity injections and inconsistent efforts to provide guarantees for household deposits.

- Russia 1999 - *index of private entry in markets (banking sector reform, enterprise reform)*
  The restructuring of the banking system has been slow, uncoordinated and inefficient. The CBR e.g. provided 'stabilisation credits' to troubled banks, but there was little control over the use of the money, and the basis

on which the selection of banks was made was never defined. In general the CBR and the Organisation for Restructuring Credit Organisations (ARCO, founded following the banking crisis) lacked the necessary skills and resources to accomplish an efficient and succesful restructuring programme. The central bank turned out to be reluctant to protect the rights of bank creditors and to ensure that bank shareholders absorb losses, seriously impairing the efficacy of the regulatory and supervisory system, moreover the CBR failed to act rapidly to define clear rules for the restructuring programme.

Although the number of bankruptcy filings increased seriously, the outcomes were not clear and part of them were induced by political motivations and reflected attempts by insiders to strip assets rather than corporate restructuring processes. Early 1999, a number of legislative acts were passed to protect specific groups of enterprises (firms of strategic significance, regional energy distribution companies, agricultural firms) from bankruptcies and to stop the initiation of bankruptcies against tax debtors. Budgetary constraints for the enterprise sector remained soft.

- Slovak Republic 1997 - *index of trade and foreign exchange liberalisation, index private entry in markets (enterprise reform)*

  Partly as a result of a persistent current account deficit, the government introduced a range of protectionist measures in the spring of 1997. These included an import deposit scheme that forced importers to deposit 20% of the imported value for 180 days in an interest free account. Later, this measure was replaced by the reintroduction of a 7% import surcharge. It applied to some 80% of all products. Other new import barriers included laws against subsidised and 'excessive' imports. Additionally, mid-1997 the government reintroduced a wage regulation that limited wage growth of public and private firms to productivity gains.[16]

  The law on 'Revitalisation of Enterprises', which came into force mid-1997, further weakened market discipline. A committee made up of government officials and bank executives would identify companies eligible for state aid in the form of tax deferrals and debt forgiveness, conditional on criteria related to employment, social and regional development, as

[16] Wage controls were abolished late 1994.

well as exports. These companies were also exempted from bankruptcy proceedings. The law induced over 1000 companies to apply for tax and debt relief.

December 1997, the third largest bank -IRB- collapsed with estimated losses of about USD 100 million. It was put under forced administration of the central bank and received a significant liquidity injection.

- Tajikistan 1993 - *index of price liberalisation*
  Limited price liberalisation was introduced in April 1991. In January 1992 the government lifted price controls on 80% of goods. Further liberalisation of prices reduced the number of goods and services under price controls to about 2% of the total. Price controls mostly applied to the staple consumer goods such as flour and milk. In 1993 price controls were reintroduced. Prices in industry were regulated under the monopoly law, and 17 basic consumer goods (including bread, rents and public transports) were controlled by executive order.

- Turkmenistan 1998 - *index of private entry in markets (large-scale privatisation)*
  In 1998, the private sector outside of agriculture still accounted for less than 10% of GDP and all large enterprises were in the public sector. January 1998, a new privatisation centre was created at the State Agency for Foreign Investment (SAFI). Its immediate aim was to privatise 18 large enterprises through international investment tenders. Only one of them, however, was sold to a domestic investor. The failure was due to the framework for privatisation that was created. In particular the practice of setting a reservation price equal to book value made the sale of firms very difficult because the true value of firms tended to be much less than their book value, resulting in unrealistically high reservation prices. The value of enterprises on offer was further reduced by the social obligations placed upon owners of privatised firms and the limited ownership rights regarding the land under enterprises.

- Turkmenistan 2000 - *index of private entry in markets (enterprise reform)*
  Off-budgetary investment funds, the President's control over most foreign currency reserves, the creation of a new President Bank and nu-

merous tax concessions made for a highly discretionary business environment. Projects that received presidential backing were rarely submitted to a market test, with all ensuing problems of endemic soft budget constraints. The government used the natural resource sector and its foreign exchange earnings to subsidise the largely outmoded domestic enterprise sector. A survey conducted in 2000 by UNDP and the government's statistical office revealed the difficult situation of most domestic enterprises. Only 28% of the 2014 enterprises reported positive growth prospects, 24% were close to bankruptcy and 48% were in financial difficulties. Taxation, limited access to foreign exchange, interference by the State Commodity Exchange and lack of access to affordable bank credit were cited as the biggest obstacles to private business. Despite the improved liquidity in the enterprise sector and the better revenue collection overall, arrears to the budget increased by 17% and arrears to suppliers increased by 25% over the first half of 2000.

- Ukraine 1998 - *index of trade and foreign exchange liberalisation*
  The collapse of the Russian rouble in August 1998 led to strong pressures on the Ukrainian hryvna. At the beginning of September the US Dollar currency band was widened. In order to keep the currency within the new band, the central bank introduced a number of restrictions on the foreign exchange market. These included e.g. a 50% export revenue surrender requirement, a ban on foreign exchange trading in the interbank market and the introduction of various licences and permits that were required to engage in foreign trade. A uniform 2% import surcharge was imposed for six months from the beginning of July (primarily to raise revenues). Many trading partners expressed their concern at the increase in import tariffs and trade barriers, especially to agricultural trade.

- Uzbekistan 1997 - *index of price liberalisation and index of trade and foreign exchange liberalisation*
  Though most formal price controls had been abolished in 1996, administrative price controls were applied to energy, rents, communal services, public transport and telecommunications. Additionally, the government determined prices of a large number of monopoly products. Procurement prices for cotton and wheat -for whom the state order system was still

in place- were also administratively set.
At the end of 1996, a general requirement for *ex ante* registration of import contracts, which basically functioned as an import-licensing system, was put in place. This reflected the priorities of the authorities at that time and gave them effective control over imports. Additionally prepayment requirements were introduced. During 1997 customs duties and export licenses were abolished, but tariffs were increased.
At the beginning of 1997, an explicit multiple exchange rate regime was institutionalised (to support activities and investment in the government's priority sectors). The official rate was used mainly for accounting and customs purposes and for export proceeds under the obligatory surrender requirement. The auction rate was applied to importers and transactions enjoying privileged access to foreign exchange (e.g. debt service payments or imported investment goods for high priority companies or projects). A special commercial (bank) rate was applied to imports of certain consumer goods and services. Both the auction and commercial bank rate were highly overvalued. The foreign exchange bureaux of the eligible banks used the cash market rate in their transactions with individuals. Finally, there was an expanded black market with a widely (though illegally) used black market rate. The difference between the official and the black market rate widened sharply since late 1996, with the latter oscillating around 40-50% of the official rate.

- Uzbekistan 1998 - *index of price liberalisation*
  Further price controls were introduced. The process of price reform remained burdened with i) widespread use of preferential prices for selected customers, ii) new price distortions caused by the multiple exchange rate system and iii) non-transparent regulations for price formation of many products and enterprises.

- Uzbekistan 1999 - *index of trade and foreign exchange liberalisation*
  In a move targeted to protect reserves, foreign exchange surrender requirements on exports were increased from 30% to 50% in January 1999. The surrendered foreign exchange was converted at the overvalued official exchange rate. Additionally Uzbekistan imposed high import duties on Kazakhstani and Kyrgyzstani imports and introduced barriers to shuttle

trade.

- Uzbekistan 2000 - *index of private entry in markets (enterprise reform)*
  The import substitution policies failed to boost industrial output. According to the index of industrial production at constant prices, output fell by more than10% during the two previous years. The decline was most pronounced among industries with a high share of foreign joint ventures, originally attracted as part of the country's industrialisation drive. Although some companies decreased their output because of reduced subsidies, most reduced their production because of increasingly distorted prices and attempted government interventions in production plans.
  The authorities also transfered 15% of GDP out of agriculture into the import substituting industries through a system of implicit and explicit taxation. As a result wages for farmers were a quarter of those in industry and there was underinvestment in the sector's infrastructure.

Appendix 1.C Empirical results with Campos-Horvath reform measures

	[1]	[2]	[3]	[4]	[5]
ΔGDP					
trend	-0.990	-0.623	-0.093	0.145	-0.746
	[3.17]	[1.79]	[0.27]	[0.44]	[2.20]
trend²	0.109	0.093	0.065	0.044	0.099
	[5.80]	[4.65]	[3.24]	[2.27]	[5.00]
trend*IC1	-0.003	-0.001	0.026	0.046	-0.006
	[0.06]	[0.03]	[0.60]	[1.09]	[0.12]
trend*IC2	-0.086	-0.148	-0.080	-0.086	-0.128
	[1.17]	[1.96]	[1.15]	[1.33]	[1.68]
RI	-34.433	-56.349	-58.931	-51.893	-56.601
	[3.77]	[4.44]	[4.89]	[4.56]	[4.47]
RI(-1)	40.721	62.921	60.686	53.674	63.987
	[4.97]	[5.34]	[5.27]	[4.94]	[5.37]
reversal*ΔRI		122.912	117.672	107.116	
		[4.56]	[4.45]	[4.34]	
reversal*					220.577
ΔRI*RI(-1)					[4.42]
fiscal balance	0.321	0.305			0.294
	[4.18]	[3.75]			[3.58]
inflation			-3.033	-1.857	
			[6.24]	[3.36]	
inflation(-1)				-1.797	
				[3.58]	
R^2	0.46	0.41	0.49	0.56	0.49
Chi^2	154.44	148.35	687.90	682.96	582.79
Panel-DW	1.87	1.86	1.95	1.88	1.89
RI					
trend*IC1	-0.003	-0.001	0.026	0.046	-0.006
	[0.06]	[0.03]	[0.60]	[1.09]	[0.12]
trend*IC2	-0.086	-0.148	-0.080	-0.086	-0.128
	[1.17]	[1.96]	[1.15]	[1.33]	[1.68]
ΔGDP	0.021	0.021	0.016	0.015	0.021
	[7.86]	[7.49]	[7.40]	[7.10]	[7.61]
ΔGDP(-1)	-0.001	-0.001	0.001	0.001	-0.001
	[0.56]	[0.74]	[0.43]	[0.73]	[0.74]
freedom	0.331	0.337	0.298	0.290	0.332
status	[3.25]	[3.12]	[3.04]	[3.00]	[3.13]
R^2	0.59	0.59	0.70	0.71	0.59
Chi^2	626.71	564.28	200.45	241.55	149.12
Panel-DW	1.86	1.89	1.89	1.86	1.88
Observations	231	231	231	231	231

Note. i) Fixed country effects are included in all regressions but not reported; ii)*Z*-statistics are reported in parentheses; iii) The Chi-square statistic indicates the overall significance of the model

Chapter 2

Reform Speed, FDI, and Economic Growth: Tale of the Tortoise and the Hare

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We analyse how the choice of reform speed and economic growth affect one another. We estimate a system of 3 equations where economic growth, economic reform and FDI are jointly determined. New reforms affect economic growth negatively, whereas the level of past reform leads to higher growth and attracts FDI. This means that the immediate adjustment cost of new reforms is counterbalanced by a future increase in FDI inflows and higher future growth through a higher level of past reform. Reform reversals contribute to lower growth. We use the model to simulate the impact of big bang reform and gradualist reform on economic growth. This is only meaningful in the presence of reform reversals, which requires aggregate uncertainty about the appropriate reform path. Using the coefficients from the empirical model we find that even relatively small ex ante reversal probabilities suffice to tilt the balance in favour of gradualism. The case for gradualism is even stronger if policymakers are short-sighted, but weaker if voters are myopic.

2.1 Introduction

The optimal speed of policy reform has been the subject of heated debate. The World Bank (WB) and even more so the International Monetary Fund (IMF) have been promoters of swift reform. The IMF's conditionality of short term stand-by agreements has often demanded quick reform of the receiving government. The crises of the last 10 years have, however, shaken this belief in quick reform and brought home the message that sequencing may be more important than previously thought. The old adage of quick and unconditional capital account liberalization for example, has not been without its problems. It is now widely recognized that successful capital account liberalization requires at least a well-established and stable domestic financial market. The experience of developing and emerging market economies has stressed with increasing success that gradual reform might be preferable to shockwise reform. There is, however, disturbingly little evidence on the specific relation between reform and growth, as noted by Skogstad and Everhart (2001). They study a set of developing countries and find empirical indications that the sequence and the magnitude of policy reform is related to economic growth.

In this chapter, we go one step further by looking at the interaction between economic reform, economic growth and FDI. This allows us to disentangle some of the mechanisms through which reform affects growth. Rather than analysing the traditional set of developing countries, we focus on a panel of 25 transition countries. Transition countries exhibit a high, but varying speed of economic reform. They also experienced substantial, but volatile inflows of FDI. This makes them perfectly suited to study the impact of the reform speed on economic growth. The paper, however, is not so much about transition but about the relation between reform speed, FDI, and growth.

The debate on the speed of economic reform surged at the start of transition when the economic profession was called upon for policy advice. Two broad streams of thought emerged, namely shock therapists, who advocated radical reforms and rapid transformation, and gradualists, advocating a more cautious and piecemeal approach to reform. Roland (2000) brings some of the theoretical work together and develops different models of transition. He shows that gradualism dominates a big bang strategy with respect to welfare in the presence of aggregate uncertainty and reversal costs (*cf.* section 0.2.1).

The empirical growth-in-transition literature initially neglected the cost of reform reversals. The standard empirical framework even imposed a short-lived positive effect of a reversal (see among others Åslund *et al.* (1996), De Melo *et al.* (1996), Fischer et al. (1996a,b), De Melo *et al.* (1997), Krueger and Ciolko (1998), Berg *et al.* (1999), Heybey and Murrell (1999), Falcetti *et al.* (2002)). This implied that economic growth was always higher with big bang reforms than with gradualist reforms. According to this line of work, some of which has been done by the IMF and the WB, more reform is always better. This was in stark contrast with theory and with the stylized fact that most policymakers did not opt for big bang policies. Merlevede (2003) showed that reversals are indeed costly and brought the empirical literature back in line with theory and stylized facts (*cf.* chapter 1).

In this chapter we contribute to this line of research in two distinct ways. First, the effect of growth and reform on FDI and vice versa has been largely neglected. We address the potential endogeneity of FDI and reform efforts in the growth equation by estimating a 3SLS-system with growth, reform, and FDI as dependent variables that are allowed to influence one another contemporaneously. Second, the estimated coefficients of this more general model are employed to investigate the effect of a reform reversal on economic growth for an average transition country that either follows a big bang or a gradualist reform path. This allows us to draw conclusions on the choice between gradualism and big bang in the real world. We find that for an average transition country, the choice for gradualism is more likely than the choice for big bang. We also show how political cycles and voter myopia might influence the policymaker's choice between big bang and gradualism.

In the next section we build and estimate the econometric model. Section 2.3 simulates and discusses the economic effects of big bang and gradualism in the presence of reform reversals. Section 2.4 provides policy implications and concludes.

2.2 Reform Speed, Growth and FDI

2.2.1 Methodological approach

In our view of the world, reform choices are the result of a politically constrained decision process affected by economic variables. They are not independent decisions (see Campos and Coricelli, 2002). The failure to consider the feedback of growth and initial conditions on reform will bias the estimated impact of reform on growth. Equivalently FDI are an important determinant of economic growth, but may in turn be influenced by economic growth and reform. In short, reform, FDI and growth may be endogenous to one another. We will therefore estimate a system of 3 simultaneous equations where economic growth, economic reform and FDI are jointly determined.

As regards the growth and reform regressions, the literature on empirical growth in transition (see introduction) has employed three categories of explanatory variables, namely macroeconomic stabilisation, initial conditions and policy reform. Macroeconomic stabilisation in the form of consumer price stabilisation, often achieved through an exchange rate peg or budgetary discipline, is found to be beneficial to economic growth. Initial conditions account to a substantial degree for the variation in economic performance at the start of transition, but their importance diminishes over time. Finally, policy reform brings economic growth through improved allocational efficiency. Most authors agree that the lagged level or the 'stock' of reform has a robust positive impact on growth and that new reforms have a negative impact on economic growth, albeit not always significant. In general, the level of reform, measured by a reform index RI, enters the growth equation in the following way: $\alpha RI_t + \beta RI_{t-1}$, where we expect $\alpha < 0$, $\beta > 0$ and $|\alpha| < \beta$. Rewriting this expression as $\alpha \Delta RI_t + (\alpha + \beta) RI_{t-1}$, reveals that new reforms (ΔRI_t) entail an immediate adjustment cost in terms of lower growth but also bring future positive ($|\alpha| < \beta$) growth through a higher stock of reform (RI_{t-1}). But if $\alpha < 0$, a reform reversal ($\Delta RI_t < 0$) generates an instantaneous positive effect on growth, slowing growth only the following year through the lower stock of reform. This was precisely the problem of the early growth in transition literature, because the positive effect of reversals is in contradiction with the theoretical literature that requires costly reversals to retain gradualism as a policy option. We therefore allow that reform reversals have a separate coeffi-

cient in the growth equation, as in Merlevede (2003).

FDI is of particular importance in developing countries, but its joint relation with growth and reform has remained largely unstudied. The recent growth literature has highlighted the dependence of growth rates on the state of domestic technology relative to that of the rest of the world. In a typical model of technology diffusion, the rate of economic growth of a backward country depends on the extent of adoption and implementation of new technologies that are already in use in leading countries (Borensztein et al., 1998). FDI is for developing countries a crucial channel to generate technology spillovers. Although there is ample theoretical work on the relation between FDI and economic growth, empirical confirmation has been scant. Borensztein *et al.* (1998) showed that the effect of FDI is conditional on a sufficient level of absorptive capacity. In contrast to the result of Borensztein *et al.* (1998), Lensink and Morrissey (2001) find a consistent positive impact of FDI and a negative impact of the volatility of FDI on economic growth. They find that the positive effect is not sensitive to other variables. Bengoa and Sanchez-Robles (2003) explore the relationships between FDI, economic freedom and economic growth for a panel of Latin American countries. They find that economic freedom increases FDI inflows (as percentage of GDP) and that both economic freedom and FDI have a positive impact on growth. Part of the impact of economic freedom on growth is therefore indirect, namely through increased FDI inflows. Campos and Kinoshita (2002) argue that transition provides a good context to test the effects of FDI. Transition countries were typically far from the technological frontier, but, in contrast with most developing countries, started with an industrial structure and a relatively educated labour force. This makes the transition countries more receptive to technology diffusion by means of FDI. Campos and Kinoshita (2002) find a significant positive impact of FDI on economic growth that is not conditional on any level of human capital, but they do not consider possible interactions with economic reform.

2.2.2 Data and empirical framework

We estimate specification (2.1) below:

$$\begin{aligned}
\Delta GDP_{i,t} &= \alpha_0 + \alpha_i + \alpha_1 RI_{i,t} + \alpha_2 RI_{i,t-1} + \alpha_3 RI_{i,t-1}\Delta RI_{i,t} D_{i,t} \\
&\quad + \alpha_4 tIC_1 + \alpha_5 tIC_2 + \alpha_6 GGB_{i,t} + \alpha_7 fdi_{i,t} + \varepsilon_{i,t} \\
RI_{i,t} &= \beta_0 + \beta_i + (\beta_1 + \beta_2 D_{i,t})\,\Delta GDP_{i,t} + \beta_3 \Delta GDP_{i,t-1} \\
&\quad + \beta_4 FS_{i,t} + \beta_5 tIC_1 + \beta_6 tIC_2 + \beta_7 fdi_{i,t} + \eta_{i,t} \\
fdi_{i,t} &= \gamma_0 + \gamma_i + \gamma_1 \Delta GDP_{i,t} + \gamma_2 \Delta GDP_{i,t-1} + \gamma_3 t \\
&\quad + \gamma_4 RI_{i,t} + \gamma_5 RI_{i,t-1} + \gamma_6 NATRES + \upsilon_{i,t}
\end{aligned} \tag{2.1}$$

Real GDP-growth (domestic currency) in (2.1) is related to a constant, a country-specific effect, two indicators of initial conditions IC1 and IC2 (these are taken from De Melo et al., 1997) multiplied by a linear time trend[1], the general government balance, the logarithm of foreign direct investment inflows, current reform, lagged reform and finally a reversal variable $RI_{i,t-1}\Delta RI_{i,t}D_{i,t}$. The dummy variable $D_{i,t}$ takes the value 1 if a reversal occurs and 0 otherwise and $\Delta RI_{i,t}$ is the change in the aggregate reform index (new reform). The specification $RI_{i,t-1}\Delta RI_{i,t}D_{i,t}$ reflects the assumption that the cost of a reversal is related to the reversal's magnitude and to the magnitude of the stock of reform at the time of the reversal. The more reform has been achieved the more costly reversals become. As stabilisation variable we choose the general government balance. Campos and Coricelli (2002) argue that inflation is a policy result, whereas the fiscal balance refers more to the policy itself. The second equation specifies the level of reform as a function of a country-specific effect, current and lagged real GDP growth, initial conditions interacted with a time trend, FDI inflows and the freedom status (FS). By analogy we also allow the immediate feedback effect of growth on reform to be different when a reversal occurs. By including FDI inflows we test whether these inflows carry an extra independent effect on reform, other than their impact through increased GDP growth. The freedom status is calculated as the average of the

[1] The level effect of IC1 and IC2 is captured by the country-specific effect.

ratings on the Freedom House political liberties and the civil rights indexes. For the sake of clarity, we use the inverse of the original indicator to have a variable that increases with political liberties and civil rights. Hence, we expect a positive value for β_4. The third equation specifies a highly stylized model of the log of FDI inflows. Inflows are modelled as a function of a country-specific effect, current and lagged real GDP growth, the current and lagged level of reform, and an indicator of the availability of natural resources in the country (rather than the clusters of different initial conditions). The country-specific effect will capture average relative market size and other unknown country-specific effects. As indicator of reform $RI_{i,t}$, we use the average EBRD index of structural reform that is kept for 25 transition countries. Detailed data definitions and data sources are given in Appendix 2.A (see also chapter 1, section 1.4).

We estimate (2.1) by a three stage least squares estimator (3SLS). Due to possible correlations in shocks and because of the endogeneity of some of the variables, the OLS assumptions are violated. 3SLS then uses an instrumental variables approach to produce consistent estimates and a generalized least squares estimation to account for the correlation structure in the disturbances across the equations. Since we use lagged values as instruments, we also report the Durbin-Watson statistic for autocorrelation generalized to the fixed effect model by Bhargava *et al.* (1982).

2.2.3 Results and interpretation

The results are presented below (we do not report the country dummies):

$$\begin{aligned}\Delta GDP_{i,t} &= \underset{(-1.51)}{-12.60} RI_{i,t} + \underset{(2.80)}{12.08} RI_{i,t-1} + \underset{(2.27)}{8.01} \Delta RI_{i,t} D_{i,t} RI_{i,t-1} \\ &\quad + \underset{(3.91)}{0.94} tIC_1 - \underset{(-0.73)}{0.22}\, tIC_2 + \underset{(2.00)}{0.18} GGB_{i,t} + \underset{(2.55)}{5.53} fdi_{i,t} \\ &\quad \mathrm{R}^2 = 0.49;\ \chi^2 = 326.9^{***};\ \mathrm{n} = 253;\ \text{panel DW} = 1.89\end{aligned}$$

$$\begin{aligned}RI_{i,t} &= \left(\underset{(4.28)}{0.059} - \underset{(-2.39)}{0.073} D_{i,t} \right) \Delta GDP_{i,t} - \underset{(-1.21)}{0.004} \Delta GDP_{i,t-1} \\ &\quad + \underset{(0.15)}{0.007} fdi_{i,t} + \underset{(2.39)}{0.79} FS_{i,t} - \underset{(-1.99)}{0.03}\, tIC_1 - \underset{(-0.33)}{0.006} tIC_2 \qquad (2.2) \\ &\quad \mathrm{R}^2 = 0.72;\ \chi^2 = 851.4^{***};\ \mathrm{n} = 253;\ \text{panel DW} = 1.90\end{aligned}$$

$$\begin{aligned}fdi_{i,t} &= \underset{(-1.09)}{-0.025} \Delta GDP_{i,t} + \underset{(2.05)}{0.016} \Delta GDP_{i,t-1} + \underset{(0.18)}{0.05} RI_{i,t} \\ &\quad + \underset{(1.99)}{0.64} RI_{i,t-1} + \underset{(2.17)}{0.69} NATRES + \underset{(5.34)}{0.16} t \\ &\quad \mathrm{R}^2 = 0.83;\ \chi^2 = 1232.3^{***};\ \mathrm{n} = 253;\ \text{panel DW} = 1.69\end{aligned}$$

As regards the effect of reform on growth, current reform has a negative effect, while lagged reform affects real output growth positively: -12.60$RI_{i,t}$ + 12.08$RI_{i,t-1}$. At first sight the negative current effect seems to dominate the positive lagged effect slightly. However, taking into account the positive impact of current and lagged reform through FDI, we obtain[2]: $-12.32RI_{i,t} + 15.62RI_{i,t-1}$, which shows that the positive 'stock' effect of reform dominates the short term adjustment cost. This is in line with earlier findings in the growth in transition literature. Rewriting yields $-12.32\Delta RI_{i,t} + 3.30RI_{i,t-1}$. This would imply that reform reversals ($\Delta RI_t < 0$) generate a counterintuitive instantaneous positive growth effect in period t, were it not for the independent reversal effect $8.01\Delta RI_{i,t} D_{i,t} RI_{i,t-1}$ that ensures a negative impact of a reversal if $RI_{i,t-1}$ is 1.5 or higher[3]. The growth rate is strongly and significantly

[2] i.e. -12.60$RI_{i,t}$ + 12.08$RI_{i,t-1}$ + 5.53 * (0.05$RI_{i,t}$ + 0.64$RI_{i,t-1}$)

[3] This negative immediate effect of a reversal occurs as soon the stock of reform reaches the value of 12.32/8.01=±1.54. In practice nearly all countries reached this level of reform after the first year of transition. A reversal therefore always has a negative impact. Pure technically, since a single component of the average RI-index takes values from 1 to 4.3 with

influenced by an increase in FDI inflows: $5.53 fdi_{i,t}$. Further results are in line with expectations. Better initial conditions, in particular a higher value of IC1, contribute to growth, and improvements in the general government balance (GGB) are found to be beneficial to growth. The positive coefficient on the interaction between the time trend and IC1 implies diverging growth rates: countries with better initial conditions will grow faster than the countries with more adverse initial conditions.

The level of the reform index is positively related to current real GDP-growth. When a reversal occurs, however, the feedback effect from growth to reform disappears. We cannot reject that $\beta_1 + \beta_2 D_{i,t}$ is equal to zero when $D_{i,t} = 1$.[4] A country's freedom status (FS) is positively associated with progress in reform. The time interacted IC1 has a statistically significant negative impact on reform, offsetting the divergent direct impact of IC1 on growth. Lagged growth has a negligible negative impact on reform. Higher FDI inflows do not induce more reform (other than via their impact on GDP growth).

For the determinants of FDI, we find a significant positive impact of the stock of reform and an upward time trend. Countries that have better natural resources receive more FDI inflows. Current real GDP growth does not seem to affect FDI inflows, but lagged growth does. We also tested whether a reversal would have an impact on FDI-inflows. The results presented in Appendix 2.B show that there is no significant impact.

For the simulations in the next section we use a mildly simpler model. Since FDI inflows do not cause extra reform efforts beyond their impact through GDP growth, we drop inflows as explanatory variable in the reform equation. We also drop the current level of reform and current real GDP growth as a determinant of FDI inflows, because they are highly insignificant. We also drop the insignificant interactions with IC2, which is in line with Falcetti *et al.* (2002) who also find that only their first principal component is significant.

steps of about $\frac{1}{3}$, 1.3 would make the lowest value at which a reversal could occur.

[4] χ^2-stat. = 0.15, p-value = 0.69

The specification used for the simulation is presented below:

$$\begin{aligned}\Delta GDP_{i,t} &= \underset{(-1.56)}{-10.79} RI_{i,t} + \underset{(3.19)}{11.17} RI_{i,t-1} + \underset{(2.56)}{7.25} \Delta RI_{i,t} D_{i,t} RI_{i,t-1} \\ &\quad + \underset{(6.08)}{0.86} tIC_1 + \underset{(2.07)}{0.17} GGB_{i,t} + \underset{(3.22)}{5.41} fdi_{i,t} \\ &\quad \mathrm{R}^2 = 0.51;\ \chi^2 = 345.8^{***};\ \mathrm{n} = 253;\ \text{panel DW} = 1.87\end{aligned}$$

$$\begin{aligned}RI_{i,t} &= \left(\underset{(13.48)}{0.058} - \underset{(-2.72)}{0.068} D_{i,t} \right) \Delta GDP_{i,t} - \underset{(-1.19)}{0.004} \Delta GDP_{i,t-1} \\ &\quad + \underset{(2.78)}{0.76} FS_{i,t} - \underset{(-3.71)}{0.03}\ tIC_1 \\ &\quad \mathrm{R}^2 = 0.73;\ \chi^2 = 871.8^{***};\ \mathrm{n} = 253;\ \text{panel DW} = 1.91\end{aligned} \tag{2.3}$$

$$\begin{aligned}fdi_{i,t} &= \underset{(4.20)}{0.50} RI_{i,t-1} + \underset{(1.97)}{0.01} \Delta GDP_{i,t-1} + \underset{(3.55)}{0.60} NATRES + \underset{(5.85)}{0.15} t \\ &\quad \mathrm{R}^2 = 0.84;\ \chi^2 = 1303.8^{***};\ \mathrm{n} = 253;\ \text{panel DW} = 1.73\end{aligned}$$

2.3 Gradualism versus big bang

We now investigate the implications of the empirical results in the previous section for the choice of reform speed. We simulate output paths under a gradualist and a big bang strategy, both with and without reversal. The effect of reform on real GDP is referred to as the 'welfare effect'[5]. We think of a big bang strategy as a strategy that immediately implements a large amount of reform and quickly hits the ceiling of maximum reform. A gradualist strategy consists in smaller reform steps and takes a longer period to attain full reform. Obviously, many different approaches to shifting an indicator from 1 to 4.3 in nine periods are possible. We focus here on the two stylized strategies, gradualism and big bang, that have been prominent both in theoretical literature and policy advice and try to shape the reform paths to the image that advisors and researchers would have in mind.

[5] A social welfare function that is linear in real GDP would allow to use these terms interchangeably.

2.3.1 Simulation results

The estimates of model (2.3) are now employed to simulate real economic growth under GR and BB for the average transition country. When simulating the model for a specific reform path, we are especially interested in the uncertainty surrounding the reciprocal influence of growth and reform on one another. This means that we are interested in capturing parameter uncertainty, rather than uncertainty that follows from possible shocks to real GDP from outside the model. In order to take this type of uncertainty into account and to create confidence bounds, we simulate the model as follows. From regression (2.3) we retrieve the vector of point estimates of the parameters, F, and the covariance matrix, Ψ. We then draw 15000 parameter sets from a multinormal distribution $N(F, \Psi)$ and solve the model for each of the parameter sets.[6] In the figures below we present averages and the 5th and 95th percentiles. For the exogenous variables and the initial values, we take the sample averages. Therefore the underlying baseline path where no reform shocks are added to the model is an outcome that results from different approaches to reform, and includes countries that not yet finished transition.[7] The baseline path also reflects that the first steps in the direction of a market economy were relatively easy to take, for it implies an increase of the reform indicator to 1.8 in the first year of transition.[8] Because (2.3) is estimated in growth rates, we construct one-period ahead confidence bounds around the output paths in the figures below. We do this by taking the previous period's implied average index as given and applying the 5th and 95th percentile of this period's growth rate to it. This is in line with the estimation in growth rates that takes the previous period's output level as given.

Exogenous reform

In order to compare the two theoretical approaches advocated in the literature, we assume in a first step that the government can implement the reform path

[6] In 356 parameter settings ($\pm 2.5\%$ of the total) the model becomes explosive and results in dependent variables that reach for $+\infty$ or $-\infty$. Rather than putting restrictions on the draws from the multinormal distribution, we exclude these parameter settings values when calculating the mean and percentiles.

[7] The upper part of table 2.3 in Appendix 2.C lists the reform levels and growth rates implied by the baseline path.

[8] This obviously also depends on the definition of the indicator by the EBRD.

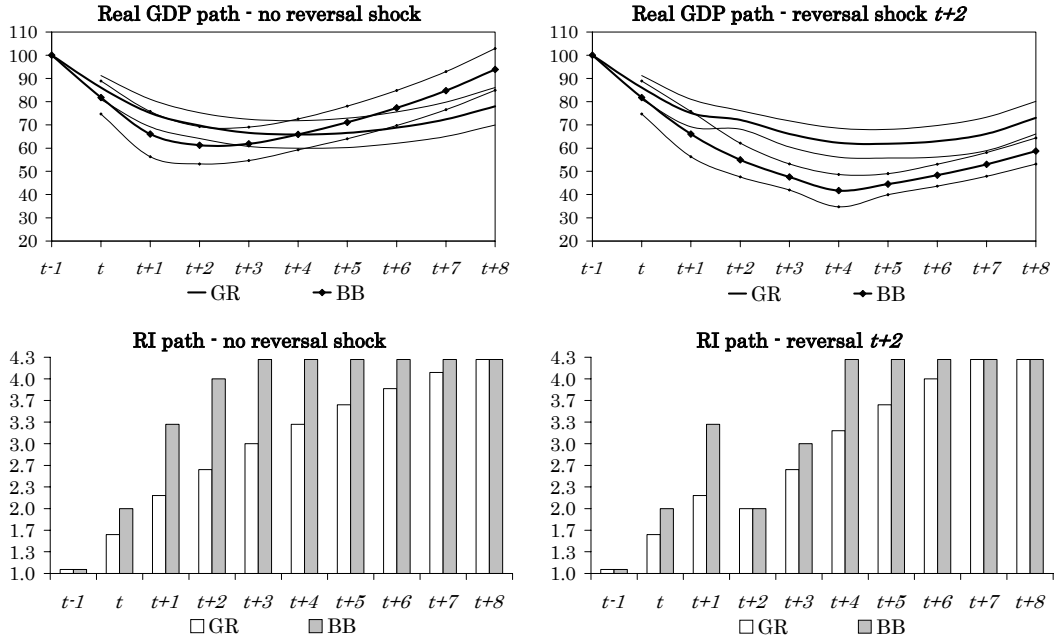

Figure 2.1: Simulated real GDP with exogenous reform paths - no reversal versus reversal at $t+2$ (90% confidence intervals in top panels)

of her choice without worrying about the feedback effects. In terms of (2.3) this is done by disregarding the RI-equation and assuming exogenous reform paths reflecting the big bang and gradual approach to reform. The lower left panel of figure 2.1 shows the reform paths in the no-reversal case. The reform paths reflect the standard picture in the literature that would come to mind when discussing gradualism and big bang. In particular a big bang strategy immediately implements a large amount of reform and hits the ceiling of maximum reform after four years of transition in *t+3*. Under a gradualist strategy on the other hand reform steps are smaller, and only in *t+8* a reform level comparable to a market economy is attained. The difference between the two reform paths is thus the reform speed, the eventual level of reform is the same. The implied output paths are shown in the upper left panel of figure 2.1. Flat lines represent gradualism and diamond lines represent big bang in both panels. Both output paths are surrounded by a 90% confidence interval.

We repeat this exercise for the case of a reform reversal. We assume a reversal to a specific level of the reform index, which is our interpretation of the return to a conservative platform (see Dewatripont and Roland, 1995).

Specifically we assume at *t+2* a return to a level of the reform index of 2, which implies that there is a small reversal for gradualism and a large one for big bang. We assume that the government does not switch its strategy after reversal. Therefore, after the reversal, the reform steps from the beginning of transition are applied to complete the reform path.[9] Should we assume equal evolutions of the reform index after the reversal, the resulting growth rates under both strategies would be more or less equal and this would imply a disadvantage for the big bang strategy (provided no further reversals occur). Simulations for reversals at *t+3* and *t+4* give comparable results. Simulating reversals even later in transition becomes trivial. In these cases the difference between big bang and gradualism in terms of the magnitude and hence the cost of reversals becomes smaller and smaller. This derives from the assumption that both gradualism and big bang arrive at full reform after 8 years. The specific reform paths in the presence of a reform reversal at *t+2* are shown in the bottom right panel of figure 2.1. We again use these reform paths to simulate economic growth. The implied output paths are shown in the upper right panel of figure 2.1.

In the no reversal case (the left panel) the real GDP-path is initially lower for big bang (diamond line) because of higher adjustment costs, but after four years (at *t+4*) the big bang path starts to exceed the gradualist path[10] (the flat line). The lower bound for the BB-path is just below the upper bound for the GR-path in *t+8*. From *t+6* onwards the mean of each simulated strategy is outside the confidence bounds of the other. In the right panel with a reversal at time *t+2* the situation is quite different: under a big bang strategy, the reversal comes at a large cost. The loss of growth is so massive that the higher growth rates later in transition induce only a negligible catch-up effect and the gradualist output level is not reached in our time window.[11] The confidence intervals of big bang and gradualism cross only at the end of

[9] For the big bang case the no reversal path is *t-1*=1.0; *t*=2.0; *t+1*=3.3; *t+2*=4.0; *t+3*=4.3. By applying the same reform steps as in the no reversal case, only starting at a level of 2.0 rather than at 1.0, we obtain: *t+2*=2.0; *t+3*=3.0; *t+4*=4.3. The same logic applies to the gradualist path after reversal at *t+2*.

[10] Assuming that once a score of 4.3 is reached the 'traditional' growth literature takes over, BB will be ahead of GR for a few more years before catch-up.

[11] Allowing a faster reform evolution in the big bang case implies higher growth rates at the end of the time window, but it also implies lower growth rates just after the reversal compared to gradualism. The big bang strategy results then in a more pronounced U-shaped pattern, but gradualism still runs ahead at $t + 8$.

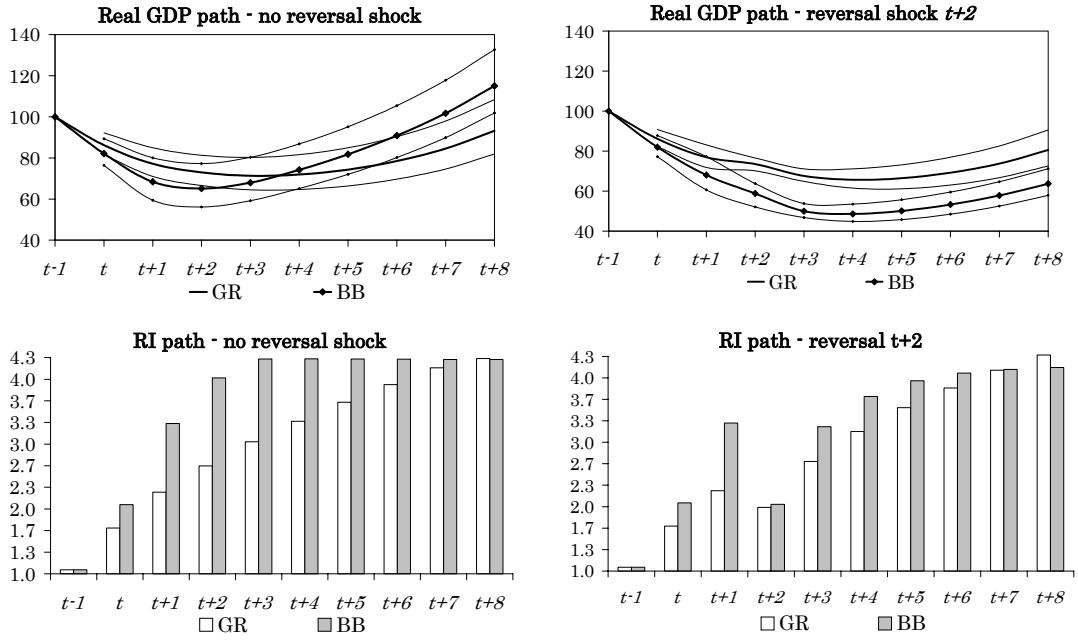

Figure 2.2: Simulated growth with endogenous reform - no reversal versus reversal at $t+2$ (90% confidence intervals in top panels)

transition. Intuitively, big bang reforms may lead quickly to a high stock of reform, which is good for growth, but this is counterbalanced by the fact that a reversal to a conservative platform will be larger and hence much more costly for big bang than for gradualism.

If it is known beforehand whether a reversal will occur or not and there is no uncertainty regarding the output paths, the choice between big bang and gradualism is trivial for a policymaker that maximizes long term economic welfare: without reversal, the big bang strategy will be applied as shown in the left panel of figure 2.1; with a reform reversal, the gradualist strategy is preferred, as shown in the right panel of figure 2.1.

Endogenous reform

The results are even stronger if reform is endogenous. The distinction between the gradualist and big bang reform paths is now established by adding reform shocks to the second equation of (2.3). These reform shocks reflect the policymaker's preferences regarding reform speed. In the no reversal case we add reform shocks to obtain a full transition path that is comparable to the exoge-

nous reform paths shown in the lower left panel of figure 2.1. In the case of a reversal we apply the same shocks as in the no reversal case, the only difference is a negative shock at *t+2*.[12] In Appendix 2.C we present detailed tables of these shocks and their implied growth rates and reform levels together with their confidence bounds.

The lower left panel of figure 2.2 shows the big bang and gradualist strategies without reversal, the lower right panel shows the strategies with reversal. The implied output path for the no reversal case (upper left panel) is fairly similar to the one in figure 2.1. Again the lower bound for the BB-path is just below the upper bound for the GR-path and from *t+6* onwards the mean outcome of each strategy is outside the bounds of the other. Whereas the mean in the case of exogenous reform does not exceed 100 (the starting value of the index), the mean reaches about 115 when reform is endogenous. The simulated output paths in case of a reversal are also comparable to those in figure 2.1. However, the confidence intervals of big bang and gradualism do no longer cross at the end of the time window (upper right panel) and the big bang path significantly remains below the gradualist path. The results with endogenous reform therefore strengthen the case for gradualism. A final remarkable result is that in the big bang case full reform is not attained in *t+8*. This is because of the lower shocks in the big bang case near the end of transition (*cf.* table 2.4 in Appendix 2.C). Our results still hold, however, if we apply the gradualist shocks to the big bang path after the reversal (*cf.* BB' in table 2.4 in Appendix 2.C).

In figure 2.3 we only apply reform shocks (the policymaker's preferences) until the reversal and let reform evolve endogenously afterwards. Table 2.3 in Appendix 2.C lists the shocks underlying figure 2.3. The resulting reform and growth paths reveal some further properties of the model. It is especially noteworthy that the effect of a shock phases out and the model quite quickly returns to its no-shock baseline. A higher level of current reform implies *ceteris paribus* a decrease in the growth rate, which in turn implies lower current reform, and so on. Clearly, this is what makes the model stable. Should both reform and growth concurrently influence one another positively, the model would be instable. From the panels on the right in figure 2.3 one can nicely infer that after an exogenous reversal the system does not slide back into the

[12] A reversal thus does not alter the policymaker's preferences.

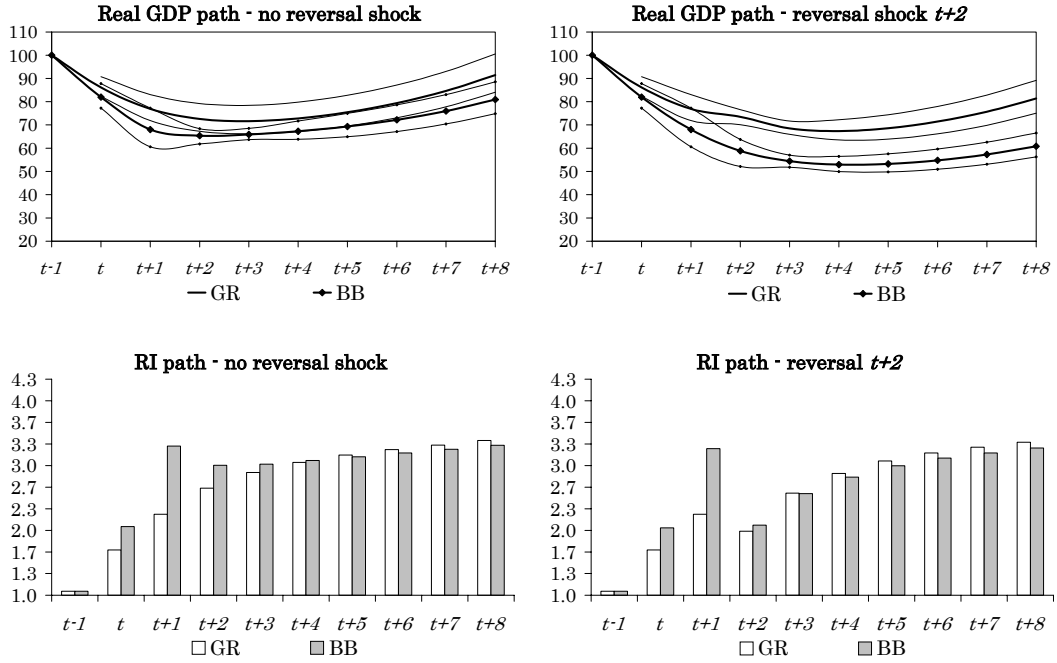

Figure 2.3: Simulated growth with endogenous reform (initial shocks only) - no reversal versus reversal at $t + 2$ (90% confidence intervals in top panels)

unreformed planned economy through further endogenous reversals, but rather evolves to the baseline. This is fairly intuitive. The point estimate of the effect of lagged GDP growth on reform is nearly zero and insignificant. Therefore, there is no channel of negative impact on reform in the year following the reversal via the strong negative growth rate induced by the reversal the year it occurs. A return to communism could therefore only originate from the impact of the decrease in the stock (i.e. the lagged level) of reform in the year following the reversal on the growth rate that then would transmit itself (via the second equation) to further lower reform. We cannot reject, however, that the impact of current growth on reform is zero in case of a reversal.[13] Therefore exogenous reversals do not trigger a self-reinforcing slide-back to communism via further endogenous reversals. A second reversal could only come from either an adverse external shock or an adverse change in one or more exogenous variables. The estimations thus reflect reality where a slide-back into communism is not observed.

[13]It cannot be rejected that $0.058 - (0.068 * D_{i,t})$ equals zero if $D_{i,t} = 1$.

2.3.2 Aggregate Uncertainty

In Dewatripont and Roland (1995) the government faces a decision under uncertainty on the choice of the speed at which some reform package is implemented. A policy package contains two reforms that can be implemented either simultaneously at high speed (big bang) or step by step at low speed (gradualism). Once implemented the speed of implementation does no longer affect the net present value of the reform package (in terms of welfare say), but the costs beared during the transitional period differ depending on *i*) the choice of policy speed and *ii*) whether or not a reversal is necessary. Without uncertainty the outcome of the package would be known in advance and it would either be rejected in case of a negative outcome or implemented as a big bang when the outcome is positive. Because partial reform, i.e. implementing only one of both reforms in the package, is costly because of complementarities, gradualism is no option without uncertainty. In the case of aggregate uncertainty, however, the ideal policy package is not known and a reversal of an inaccurate package (with negative net present value) cannot be ruled out. Dewatripont and Roland (1995) point to the crucial role of reversal costs in this case. If there are no costs of reversing, big bang will be optimal because there are no costs of experimenting. If a reversal is costly and the option of early reversal is exercised with positive probability (which is likely in case of aggregate uncertainty) gradualism will dominate.

In our framework uncertainty means that policymakers have imperfect information about the type of reform best fit for their country.[14] Some reform steps may turn out to be inappropriate or inconsistent with other reforms. Reversals are then interpreted as a normal component of the trial and error process in search of the appropriate market economy model. We focus on a government that at the start of transition needs to make a choice between a gradualist and a big bang strategy as depicted in figures 2.1 and 2.2. The choice will then depend on the expected probability of a future reversal (hence aggregate uncertainty), i.e. the probability of ending up in the right panel of these figures. The degree of uncertainty can be understood as a barrier to immediate big bang reform.

[14]Market economies are characterised by a set of core characteristics but many varieties exist. A score of 4.3 on RI can be interpreted as 'a score equivalent to a market economy', without telling the exact type.

criterion\timing of reversal	$t+2$	$t+3$	$t+4$
1. GDP_T	0.52	0.41	0.43
2. $\sum_{t=-1}^{T} GDP_t$	0.29	0.26	0.31
3. $\sum_{t=-1}^{T} 0.95^{t+1} GDP_t$	0.24	0.22	0.28

Table 2.1: Minimum probability assigned to reversal to prefer gradualism to big bang

Assume that policymakers are risk-neutral, benevolent social welfare planners and that reform policies are decided at the beginning of transition in function of *ex ante* expectations about future reform reversals. Without uncertainty, there will be no reversals and immediate big bang[15] is optimal. The level of aggregate uncertainty in the eye of the policymaker will therefore determine her choice.

Table 2.1 reports the minimal *ex ante* probabilities a policymaker should assign to a reversal in a specific year in order to prefer gradualism at the start of transition.[16] The probabilities are based on model (2.3) with endogenous reform as in figure 2.2. We consider three possible criteria policymakers may use to make this choice. In line 1, the policymaker focuses on the GDP-level at the end of transition T[17]. If policymakers only care for the level of real GDP at the end of transition, the expected probability of reversal should be about 0.5 to opt for gradualism. In line 2 (3) the policymaker focuses on the cumulated (cumulated discounted) GDP-levels until the end of transition T. Even lower *ex ante* reversal probabilities (not higher than 0.31) now tilt the policymaker's decision in favour of gradualism. The reversal probability needed to prefer gradualism will increase if the reversal is expected later than *t+4*. Indeed, further down in transition the levels of reform converge, and so

[15] Immediate big bang means that reform immediately jumps to full reform (reform index 4.3). This leads to maximum economic growth because the stock effect.dominates and is immediately maximized.

[16] Underlying RI-paths are obtained by taking the no reversal-path from figure 2.2 until the time of the reversal and completing it with the simulated endogenous reform path; we always simulate until 6 years after the reversal. The reform paths in the no reversal case are extended by adding extra years with a score of 4.3 which implies for these year identical growth rates for both GR and BB; criterion: line 1 - GDP-level at the end of transition, line 2 (3) - cumulative (cumulative discounted) GDP-levels until the end of transition.

[17] The end of transition is defined as the second year with a score of 4.3 for the reform indicator for gradualism, the slowest reform policy. This allows the stock effect of reform to mature. See also the notes with table 2.1.

do the costs of reversal that drive the difference between gradualism and big bang in our simulation. This can also be seen from the bottom left panel in figure 2.2. Initially the big bang reforms run ahead, but from *t+4* onwards the reform gap narrows and the costs of reversal converge, essentially because big bang reforms have hit the ceiling of maximum reform. Also, the weight of the initial adjustment cost of a big bang reform in cumulated GDP decreases if we are further down the road of transition. It is concluded that, if policymakers care about cumulated or cumulated discounted welfare during transition, then relatively low levels of aggregate uncertainty, as reflected in the expected probability of reversal, are sufficient to tilt the balance in favour of gradualism for the average transition country. If policymakers care only about economic welfare at the end of transition, reversal probabilities of about 0.5 are needed to guide them towards gradualism.

Given the complexity of the transition process, the case for gradualism seems therefore rather strong for the average transition country and it may take hard-nosed reformers to opt for a big bang strategy. The economic intuition is simple: if you don't know which way to run, it may be wise to run a bit slower in order to limit the cost of having to return on your steps.

2.3.3 Politics

In the previous paragraph we looked at a benevolent, risk-neutral, social welfare planner whose horizon extended to the end of transition. Policymakers are, however, subject to political constraints that may give rise to political cycles in policy making (see Alesina and Roubini, 1992; Persson and Tabellini, 2000). Political constraints make politicians prefer current to future welfare to an extent that exceeds the normal discount factor. The reason is that future welfare may only be enjoyed after the next election and may therefore not be included in the politicians' utility function. The standard democratic political cycle spans 4 years at best, but in transition countries it was on average even shorter. Since reform packages have an impact on future real GDP, their design by politicians in transition countries is subject to severe political constraints (see Dewatripont and Roland, 1992). We will address this problem in a very simple and intuitive way, assuming that policymakers are politicians that care about the opinion of voters at the expected time of election, rather than maximize some criterion at the end of transition.

As a starting point assume that voters, and hence politicians, care for aggregate economic welfare, i.e. the level of real GDP, at the time of the election. Assume also that at the time of the policy decision, the time of elections is a maximal span of 4 years away. So the only thing that matters is the *ex ante* expected economic welfare at *t+4* under both policy scenarios. In the reversal case (see right panel of figure 2.2) gradualism dominates big bang, while in the no-reversal case (left panel of figure 2.2) real GDP under big bang exceeds that of gradualism only from *t+4* on.[18] If the elections take place prior to *t+4*, then policymakers will always prefer gradualism to big bang, even if the probability of a reversal is zero. Should the first elections take place at *t+4*, we calculated that the *ex ante* expected probability of a reversal at time *t+2* should be below 0.12 for big bang to be preferable. For reversals at time *t+3* and *t+4* the respective values are 0.09 and 0.08.

Alternatively we could assume that voters have a memory and thus care about cumulated economic welfare until the time of election. The positive results of the big bang strategy will then materialize even later in transition. Our calculations (not reported here) indicate that cumulated welfare under a big bang policy only exceeds that of gradualism in *t+6*. Even if the first elections were to take place only in *t+6*, extremely small reversal probabilities would still be sufficient for gradualism to be preferred. For reversals at *t+2* the probability should be less than 0.04; at time *t+3* and *t+4*, the corresponding values are 0.03 and 0.02. In short, if you take into account political cycles, tiny levels of policy uncertainty are sufficient to tilt the balance in favour of gradualism and big bang strategies seem to belong to the realm of the unreal. These results prompt policymakers to opt for gradualism, unless they do not care for their political survival.

However, differences in economic welfare may be the wrong political criterion. Since voters only observe the outcome of the chosen strategy, not of the alternative, they are imperfectly informed too and therefore not able to compare both strategies' economic welfare. Because it is clearly observed, the turning point from negative to positive growth might be a better criterion for voter behaviour, and hence policymakers' behaviour. Assume that vot-

[18] Taking into account confidence bounds, the mean of BB is outside the confidence bound around the mean of GR only in $t+5$, and vice versa. Taking into account both confidence bounds it takes until $t+8$ for BB to outrun GR significantly. Therefore risk-averse politicians would be very unwise to opt for big bang.

	t	$t+1$	$t+2$	$t+3$	$t+4$	$t+5$	$t+6$
No reversal							
Big bang	-17.9	-16.7	-4.8	**4.3**	9.2	10.2	11.1
Gradualism	-13.7	-10.5	-5.4	-2.2	-0.8	**3.3**	5.6

Table 2.2: Real GDP growth rates implied by the simulations

ers leave the incumbent policymakers in power only if the turning point has been reached by the time of the election. Fidrmuc (2000) finds statistically significant associations between unemployment and voting in Czech Republic, Hungary, Poland and the Slovakia. Jackson *et al.* (2003) find that Polish regions with higher levels of new firm and job creation return larger votes shares for the economically liberal UD+KLD pseudo-coalition in 1993 and for the UW that was in power in 1997. These votes come at the expense of both the post-communist and right wing and trade union parties. Hence voters react to economic outcomes they experience. In our setting we do not have unemployment nor firm or job creation, but these are strongly related to positive economic growth. It is therefore not unwise to assume that voters vote for the incumbent if the economy has turned to positive growth and for the opposition otherwise. This behaviour can be labelled myopic because voters do not take into account the growth effects of alternative policies. Instead their choice is based solely on economic outcomes actually observed.

Table 2.2 reveals that the big bang strategy now offers better prospects for re-election. Indeed, in the no reversal case big bang achieves positive growth rates before gradualism does, while in the reversal case growth rates are comparable (*cf.* tables 2.3 and 2.4 in Appendix 2.C).[19] More importantly, in the no reversal case big bang policies deliver positive growth rates within the standard political cycle of four years, while gradualist policies fail to do so.

Thus, although the short-sightedness of policymakers drives them towards gradualism, their awareness of imperfect information in the voter's eye has a countervailing effect and may encourage them to gamble for a big bang without a reversal. This table does not bring good news for incumbent policymakers in an average transition country. If voters are myopic, gradualist policymakers are not re-elected and big bang policymakers are also set to loose power in case

[19] Should a big bang strategy imply that -after the reversal- reform increases faster than in the gradual case, growth rates would turn positive earlier also.

of a reversal. The only way to maintain power is to gamble for a big bang and to steer clear of major mistakes and the reversals that come with them. But this may come at a high political and economic cost if a reversal turns out to be necessary anyhow. Note that one could apply many different criterions for voter behaviour. We choose the criterion of the turning point, because it is the most favourable to big bang. Even then the prospects for re-election are not good. Any other criterion is less favourable to big bang, and reinforces the case for gradualism.

2.4 Conclusions

Our main interest is the relation between the choice of reform speed and economic growth. We estimated a system of 3 equations where economic growth, economic reform and FDI are jointly determined. We found that new reforms affect economic growth negatively but that the level of past reform leads to higher growth and attracts FDI. FDI is also attracted by improvements in the growth rate, but with a lag. This means that the immediate adjustment cost of new reforms is counterbalanced by a future surge of FDI inflows and higher future growth through a higher stock of reform. Reform reversals on the other hand are found to contribute to lower growth.

We use the model to simulate the impact of big bang and gradualist reform on economic growth. This is only meaningful in the presence of reform reversals. If we know whether a reversal will occur or not, the choice between big bang and gradualism is trivial for a benevolent policymaker that maximizes long term economic welfare: without reversal, the big bang strategy will be applied, with a reform reversal, the gradualist strategy is preferred. In the presence of uncertainty about the appropriate reform path and hence reversals, relatively small *ex ante* reversal probabilities suffice to tilt the balance in favour of gradualism for a benevolent policymaker.

If policymakers are short-sighted because of political cycles they will never prefer big bang strategies to gradualism. Because of higher initial adjustment costs of a big bang strategy, the potential benefits from reform and FDI only materialize after the elections. The only possible countervailing argument stems from voter myopia. If voters react only to the economy's turning the corner, a big bang policy may offer better prospects for re-election. Still voter myopia

brings mainly bad news for policymakers. Gradualist policymakers are never re-elected. Big bang policymakers are unable to maintain power in case of a reversal. The only way to stay in power is to gamble for a big bang and then to have the luck not to make any major mistakes and hence avoid a reversal. But this may come at a high political and economic cost if a reversal occurs anyhow. All in all, it is not surprising that political instability has been a typical feature in transition and developing countries alike, and that economic reform is generally hard to achieve, for the political fruits of economic reform may be bitter.

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UNCTAD, Online FDI Database, *www.unctad.org*

Appendix 2.A Data Issues

Especially early in transition the decline in output is believed to be overestimated. Since statistical systems were originally designed to collect information from state-owned enterprises they probably failed to capture large parts of the emerging private sector. Additionally, the use of pre-transition relative prices resulted in low weights for newly emerging activities (Berg *et al.,* 1999). Furthermore, both newly emerging activities and existing firms had an incentive to underreport output and sales to avoid taxes and regulation. Studies that use adjusted GDP data conclude that their results on growth determinants are not sensitive to the corrections to the data (See e.g. Loungani and Sheets, 1997 and Selowsky and Martin, 1997). Bearing these caveats in mind, we proceed using official data.

The aggregate reform index (RI) is constructed as a weighted average of eight transition indexes as found in the EBRD's Transition Report. The indexes can take values between 1 and 4.3 with steps of about $\frac{1}{3}$. A score of 4.3 is a situation comparable to a market economy; a value of 1 denotes a centrally planned system. These indicators reflect the progress of reform with respect to *i*) price liberalization (weight 0.3), *ii*) trade and foreign exchange liberalization (weight 0.3), and *iii*) privatisation, restructuring and financial market reform (weight 0.4) (see also De Melo *et al.* (1996)). The former two are directly available from the EBRD Transition Report, the latter is the average of six indices. A reversal is defined as a drop in the aggregate reform index, i.e. RI_t-RI_{t-1}<0. Clearly, the transition indexes are not perfect since they are subjective ratings. The ratings reflect the EBRD's assessment of both the effectiveness and extensiveness of policy measures, based on sometimes incomplete or imperfect information. Moreover macroeconomic performance has often already been observed at the moment of assessment, which is a source of possible endogeneity.

All data were rearranged in 'transition timing'. In order to identify common elements across countries of the post-communist economic cycle, we have to take into account the cycle's different starting points. Transition year 1 (t) is then defined as the year in which communism and central planning were definitively abandoned. This is 1990 for Croatia, Hungary, FYR Macedonia, Poland and Slovenia; 1991 for Albania, Bulgaria, the Czech and Slovak Re-

public and Romania. For the Baltic States and the countries of the Former Soviet Union 1992 is taken to be the first year of transition.

	Description
ΔGDP	Real GDP growth, domestic currency, annual percentage change
FB	Fiscal balance, consolidated balance of general government, variable is negative if the balance is in deficit
INF	End year inflation, transformed as ln(1+(Inflation/100))
RI	Reform index, see paper/Appendix A for construction
D	Reversal dummy =1 if RI_t-RI_{t-1}<0
$IC_{1,2}$	Initial condition clusters
FS	Freedom Status, average of political rights and civil liberties indexes; index ranges from 1 (free) to 7 (not free), original rating is inversed and rescaled (1=free; 0.14=not free) see also www.freedomhouse.org/research/freeworld/2000/methodology.htm
FDI	FDI inflows in millions USD

	Data Sources
ΔGDP	IMF, World Economic Outlook Database
FB	EBRD Transition Report
INF	EBRD Transition Report
RI	Own calculations based on indicators in EBRD Transition Report
D	idem
$IC_{1,2}$	De Melo et al. (1997)
FS	Freedom House
FDI	UNCTAD online FDI Database

Appendix 2.B Reform Reversals and FDI Inflows

$$
\begin{aligned}
\Delta GDP_{i,t} &= \underset{(0.49)}{6.45} - \underset{(-1.74)}{19.69} RI_{i,t} + \underset{(3.06)}{15.82} RI_{i,t-1} + \underset{(2.38)}{10.76} \Delta RI_{i,t} D_{i,t} RI_{i,t-1} \\
&\quad + \underset{(5.20)}{0.93} tIC_1 - \underset{(-0.32)}{0.08}\, tIC_2 + \underset{(2.91)}{0.27} GGB_{i,t} + \underset{(2.50)}{5.82} FDI_{i,t} \\
&\quad \mathrm{R}^2 = 0.40;\ \chi^2 = 287.5^{***};\ \mathrm{n} = 253 \\
RI_{i,t} &= \underset{(7.85)}{1.84} + \underset{(12.31)}{0.055} \Delta GDP_{i,t} - \underset{(-1.21)}{0.003} \Delta GDP_{i,t-1} \\
&\quad + \underset{(3.21)}{1.00} FS_{i,t} - \underset{(-4.14)}{0.03}\, tIC_1 + \underset{(0.44)}{0.005} tIC_2 \\
&\quad \mathrm{R}^2 = 0.75;\ \chi^2 = 817.6^{***};\ \mathrm{n} = 253 \\
FDI_{i,t} &= - \underset{(-0.70)}{0.59} + \underset{(3.54)}{1.22} RI_{i,t} + \underset{(4.20)}{1.13} NATRES + \underset{(5.06)}{0.14} t \\
&\quad - \underset{(-1.14)}{0.01}\, \Delta GDP_{i,t} - \underset{(-1.14)}{0.31}\, \Delta RI_{i,t} D_{i,t} RI_{i,t-1} \\
&\quad \mathrm{R}^2 = 0.83;\ \chi^2 = 1275.6^{***};\ \mathrm{n} = 253
\end{aligned}
$$

Appendix 2.C Shocks and implied growth rates and reform

Tables 2.3 and 2.4 present a detailed overview of the results of the simulations with endogenous reform. Table 2.3 starts with the no-shocks baseline result. Further we present the results for the gradualist and big bang strategy with only shocks in the initial periods. Table 2.4 shows the same strategies, where the shocks now have been chosen in such a way that transition is completed at the end of the period. A simulation is presented by the shocks added to the second equation in (2.3) in the first line, followed by three lines where the mean of reform (RI mean) is surrounded by the 5th (RI low) and 95th (RI high) percentiles from the 15000 repetions of the model, and finally three lines with the mean, 5th, and 95th percentiles of GDP growth rates (GDP mean, GDP low, and GDP high respectively). Figure 2.3 again shows a four-panel graph, but now of the reform and output paths simulated with initial shocks only in table 2.3.

		t	*t+1*	*t+2*	*t+3*	*t+4*	*t+5*	*t+6*	*t+7*	*t+8*
Baseline	shock	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RI low	1.7	2.1	2.4	2.5	2.7	2.7	2.8	2.9	2.9
	RI mean	1.9	2.4	2.7	2.9	3.1	3.2	3.3	3.3	3.4
	RI high	2.2	2.8	3.2	3.4	3.6	3.7	3.8	3.9	3.9
	GDP low	-20.2	-16.0	-11.4	-8.1	-5.9	-4.4	-3.0	-1.9	-0.7
	GDP mean	-15.9	-9.7	-4.2	-0.5	2.0	3.8	5.3	6.6	8.1
	GDP high	-10.6	-1.8	4.6	9.0	11.8	13.9	15.7	17.2	18.8
No reversal										
BB	shock	0.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RI low	1.8	2.8	2.6	2.8	2.8	2.8	2.8	2.8	2.9
	RI mean	2.1	3.3	3.0	3.0	3.1	3.1	3.2	3.3	3.3
	RI high	2.4	3.9	3.4	3.3	3.4	3.6	3.7	3.7	3.8
	GDP low	-22.8	-26.1	-9.1	-2.6	-3.2	-3.5	-3.1	-2.5	-1.5
	GDP mean	-18.0	-17.0	-3.9	0.8	2.1	3.0	4.2	5.2	6.5
	GDP high	-12.2	-5.8	0.6	4.8	8.8	11.4	13.4	15.0	16.5
GR	shock	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	RI low	1.5	1.9	2.3	2.5	2.6	2.7	2.8	2.9	2.9
	RI mean	1.7	2.2	2.7	2.9	3.0	3.2	3.2	3.3	3.4
	RI high	1.9	2.6	3.1	3.4	3.5	3.7	3.8	3.9	3.9
	GDP low	-17.7	-16.6	-12.6	-8.8	-6.3	-4.5	-3.1	-2.0	-0.7
	GDP mean	-13.9	-10.7	-5.6	-1.3	1.6	3.6	5.3	6.6	8.0
	GDP high	-9.2	-3.5	3.0	8.0	11.4	13.7	15.5	17.1	18.8
Reversal										
BB	shock	0.3	1.3	-1.0	0.0	0.0	0.0	0.0	0.0	0.0
	RI low	1.8	2.8	1.3	2.3	2.5	2.7	2.7	2.8	2.9
	RI mean	2.1	3.3	2.0	2.6	2.8	3.0	3.1	3.2	3.3
	RI high	2.4	3.9	2.5	2.8	3.2	3.4	3.6	3.7	3.8
	GDP low	-22.8	-26.1	-23.4	-11.9	-8.2	-6.0	-4.3	-3.1	-1.8
	GDP mean	-18.0	-17.0	-13.5	-7.5	-2.7	0.6	2.9	4.6	6.2
	GDP high	-12.2	-5.8	-6.2	-3.0	3.8	8.7	12.0	14.3	16.1
GR	shock	-0.3	-0.1	-1.0	0.0	0.0	0.0	0.0	0.0	0.0
	RI low	1.5	1.9	1.8	2.4	2.6	2.7	2.8	2.9	2.9
	RI mean	1.7	2.2	2.0	2.6	2.9	3.1	3.2	3.3	3.4
	RI high	1.9	2.6	2.2	2.8	3.3	3.5	3.7	3.8	3.9
	GDP low	-17.7	-16.6	-8.8	-10.3	-7.2	-5.1	-3.5	-2.2	-0.9
	GDP mean	-13.9	-10.7	-4.4	-6.8	-1.7	1.8	4.2	5.9	7.5
	GDP high	-9.2	-3.5	-0.4	-2.5	5.4	10.5	13.7	15.9	17.9

Table 2.3: Shocks to the baseline and implied growth rates and reform: Initial shocks

		t	*t+1*	*t+2*	*t+3*	*t+4*	*t+5*	*t+6*	*t+7*	*t+8*
No reversal										
BB	shock	0.3	1.3	1.3	1.1	0.9	0.8	0.8	0.7	0.7
	RI low	1.8	2.7	3.3	3.6	3.6	3.6	3.6	3.6	3.6
	RI mean	2.1	3.3	4.0	4.3	4.3	4.3	4.3	4.3	4.3
	RI high	2.4	4.1	4.9	5.3	5.3	5.2	5.2	5.2	5.2
	GDP low	-23.6	-27.6	-17.9	-9.1	-4.1	-3.0	-1.9	-1.0	0.1
	GDP mean	-17.9	-16.7	-4.8	4.3	9.2	10.2	11.1	12.0	13.1
	GDP high	-10.7	-2.5	13.0	23.3	27.8	28.2	28.9	29.7	30.5
GR	shock	-0.3	-0.1	0.0	0.2	0.4	0.5	0.7	0.8	0.9
	RI low	1.5	1.9	2.2	2.5	2.8	3.1	3.3	3.5	3.7
	RI mean	1.7	2.3	2.7	3.0	3.4	3.6	3.9	4.2	4.3
	RI high	2.0	2.7	3.2	3.7	4.0	4.4	4.7	5.0	5.3
	GDP low	-18.5	-17.7	-13.7	-11.6	-9.4	-7.7	-6.2	-5.0	-3.1
	GDP mean	-13.7	-10.5	-5.4	-2.2	-0.8	3.3	5.6	7.7	10.2
	GDP high	-7.8	-1.5	5.4	10.0	14.4	18.1	21.5	24.8	28.2
Reversal										
BB	shock	0.3	1.3	-1.0	1.1	0.9	0.8	0.8	0.7	0.7
	RI low	1.8	2.8	1.3	2.9	3.3	3.5	3.6	3.6	3.6
	RI mean	2.1	3.3	2.0	3.2	3.7	4.0	4.1	4.1	4.2
	RI high	2.4	3.9	2.5	3.6	4.2	4.5	4.7	4.8	4.8
	GDP low	-22.8	-26.1	-23.4	-20.5	-10.2	-5.9	-3.3	-1.5	0.1
	GDP mean	-18.0	-17.0	-13.5	-15.0	-2.7	3.0	6.4	8.5	10.2
	GDP high	-12.2	-5.8	-6.2	-8.6	7.0	14.5	18.8	21.3	23.2
GR	shock	-0.3	-0.1	-1.0	0.2	0.4	0.5	0.7	0.8	0.9
	RI low	1.5	1.9	1.8	2.5	2.8	3.1	3.4	3.6	3.8
	RI mean	1.7	2.2	2.0	2.7	3.2	3.5	3.8	4.1	4.3
	RI high	1.9	2.6	2.2	3.0	3.6	4.1	4.4	4.8	5.1
	GDP low	-17.7	-16.6	-8.8	-11.8	-9.0	-6.9	-5.1	-3.6	-1.6
	GDP mean	-13.9	-10.7	-4.4	-8.0	-2.8	1.1	4.2	6.6	9.2
	GDP high	-9.2	-3.5	-0.4	-3.3	5.3	11.3	15.8	19.3	22.8
BB'	shock	0.3	1.3	-1.0	0.2	0.4	0.5	0.7	0.8	0.9
	RI low	1.8	2.8	1.3	2.4	2.8	3.1	3.3	3.5	3.7
	RI mean	2.1	3.3	2.0	2.7	3.1	3.5	3.8	4.0	4.3
	RI high	2.4	3.9	2.5	3.0	3.5	4.0	4.4	4.7	5.0
	GDP low	-22.8	-26.1	-23.4	-13.3	-9.9	-7.8	-6.0	-4.6	-2.7
	GDP mean	-18.0	-17.0	-13.5	-8.8	-3.9	-0.2	2.7	5.1	7.7
	GDP high	-12.2	-5.8	-6.2	-4.0	3.6	9.6	14.1	17.6	21.1

Table 2.4: Shocks to the baseline and implied growth rates and reform: Full transition shocks

Chapter 3

How to Catch Foreign Fish? FDI and Privatisation in EU Accession Countries

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This chapter presents a partial adjustment approach to FDI stocks and its determinants. In this framework the observed FDI stock is the result of two driving forces. First, the stock converges towards its equilibrium level, even without policy changes. Second, the equilibrium level itself is driven by changes in its determinants. By means of a dynamic panel data analysis we examine the determinants of investment by 'old' EU-members in ten countries of Central and Eastern Europe. We find a rapid adjustment towards equilibrium. Traditional variables, such as market potential, trade integration, and relative unit labour costs, are fairly stable as determinants of equilibrium FDI stocks in transition economies. Institutional development in all its forms is a robust determinant of the optimal level of FDI. The relationship between FDI and the privatization process is complex. Non-direct privatization schemes negatively affect the speed of adjustment towards the equilibrium, whereas current direct privatization strategies positively affect the equilibrium level of FDI. Privatization history increases equilibrium FDI, independently of the method applied.

3.1 Introduction

Attracting FDI is high on the priority list of many policy makers because FDI is widely regarded as an amalgamation of capital, technology, marketing, and management, especially in developing economies (*cf.* chapter 4). Policy makers therefore have a genuine interest to know the factors that attract FDI. From a theoretical point of view it is necessary to identify the conditions under which foreign investment will take place, because of the costs inherent to entering new markets and producing abroad (Markusen, 1995). Although considerable work has been done, there is no consensus model providing the basis for empirical work. The questions and the analytical approaches to answer them are drawn from different subfields of economic theory. Some approaches stem from the larger field of macroeconomics, some relate to general equilibrium trade theory, and some are more closely related to the theory of the firm, the latter using the tools of game and information theory (see Markusen and Maskus, 2001). The macro-approach typically consists in estimating the effect of potential determinants of FDI by regressing some transformation of FDI on a set of independent variables which on theoretical grounds would likely affect the profitability of investment. These variables reflect or affect the local market potential, the cost of production, and the general business environment. Following the growing literature that relates institutions to economic outcomes, we add institutional development to the list of determinants. Institutions have become an important aspect of the locational advantages of a potential host country (see for example Kinoshita and Campos, 2003, or Bevan *et al.*, 2004).

We examine the determinants of foreign direct investment into the countries of Central and Eastern Europe (CEECs) by EU member states. Prior to 1990 the scope for FDI was extremely limited in Central and Eastern Europe. The sudden collapse of the central planning system opened these countries to foreign investment resulting in a continuous flow of investment to the CEECs. The specific nature of the transition process makes CEECs perfectly suited for analysing the impact of institutional changes on foreign investment. The considerable variation in the speed and the nature of institutional development across CEECs enables this analysis. Especially the organization of the privatization process of formerly state-owned enterprises deserves a closer look, for it has been explicitly used as an element in strategies to attract or prevent

FDI. Hungary, for example, encouraged foreign involvement in the privatization process by tailoring privatization schemes to foreigners. Prospective EU membership and integration in the EU are another 'institution' that could be an important determinant of FDI in transition countries. Indeed, Baldwin *et al.* (1997) attribute the bulk of the gain from EU membership to increased investment, coming from both reduced domestic risk and increased FDI flows.

Given the state of economic and institutional development, there exists an equilibrium level of foreign penetration in an economy. As FDI was zero at the outset of transition, it is unlikely that the optimal level has been reached at once. Therefore we think of FDI flows as an adjustment process towards an equilibrium level of the FDI stock. The observed FDI stock is then the result of two forces. On the one hand the stock will be evolving towards an equilibrium level even without policy changes or changes in other determinants. On the other hand the equilibrium level itself is continuously altered by changes in its determinants. We specify a partial stock adjustment model that nicely reflects the main features of the process of FDI inflows, namely i) investment takes time to adjust towards the equilibrium FDI stock, ii) investment depends on the actual stock, and iii) the equilibrium stock itself changes with the state of development. To date the empirical literature has largely ignored the dynamic aspects of the FDI process in transition countries. Kinoshita and Campos (2003) and Carstensen and Toubal (2004) are the exceptions. Kinoshita and Campos (2003) analyse FDI inflows at the country level which results in a more limited number of cross-section elements. Carstensen and Toubal (2004) also consider bilateral flows from the EU to the candidate countries. We differ from their analysis by developing a partial adjustment model into a dynamic panel setup where we eventually allow the speed of adjustment to the equilibrium to be influenced by the choice of the privatization strategy. The estimations are performed using a generalized method of moments (GMM) technique following Blundell and Bond (1998). We further apply a finite sample correction to the two step standard errors as suggested by Windmeijer (2000).

The structure of the chapter is as follows. Section 3.2 describes some stylized facts of FDI, the transition process, and the investment flows from the EU to Central and Eastern Europe. Section 3.3 develops a partial adjustment model of FDI and introduces the determinants of the equilibrium FDI stock. The data and estimation procedure are discussed in section 3.4, while section

	1990	1992	1994	1996	1998	2000	2002
EU	96773	72359	76852	110736	249934	683893	374380
United States	48422	19222	45095	84455	174434	314007	30030
South & Central America	9701	18446	29702	50198	82040	95358	56019
South East Asia	22120	30105	65799	88682	90093	138698	88613
Transition Countries	640	4801	7228	15667	25476	28244	32744
World	208674	166967	255901	384960	686028	1392957	651189

source: UNCTAD online database

Table 3.1: FDI inflows in millions of USD

3.5 contains the results. Section 3.6 concludes.

3.2 FDI and transition

From table 3.1 one can infer that FDI flows have risen substantially throughout the last decade, although the rise is non-monotonous. This holds both for the world as a whole, as for the regions displayed in table 3.1. The severe emerging market crises of the late 1990s did apparently not seriously affect the level of worldwide FDI-inflows even in the emerging regions. It merely temporarily slowed down the growth rate of inflows in South East Asia (it did affect the distribution across countries and regions though). The world economic slowdown and the worsening of the international climate after the events on September 11 2001 yielded substantially lower inflows in 2002. In 2002 the worldwide inward FDI stock amounted to 7122 billions of USD, which exceeds the 1990 level of 1954 billions of USD with 265%. FDI stocks in transition countries have continuously been rising to date. In 2002 the total inward FDI stock in transition countries was worth 213 billions of USD.

Figure 3.1 presents a relative perspective and shows the percentages of total world inward FDI attracted by different regions. Together with table 3.1, this picture illustrates that FDI is mainly an intra-industrialised countries phenomenon. The EU and the US account for more than 50% of total FDI.[1] Emerging regions as South America and South East Asia (including China) lost track after the emerging market crises in 1997-1998, while the EU became popular as a safe haven. These international trends seem not to have affected

[1] The EU figures do, however, include intra-EU FDI flows.

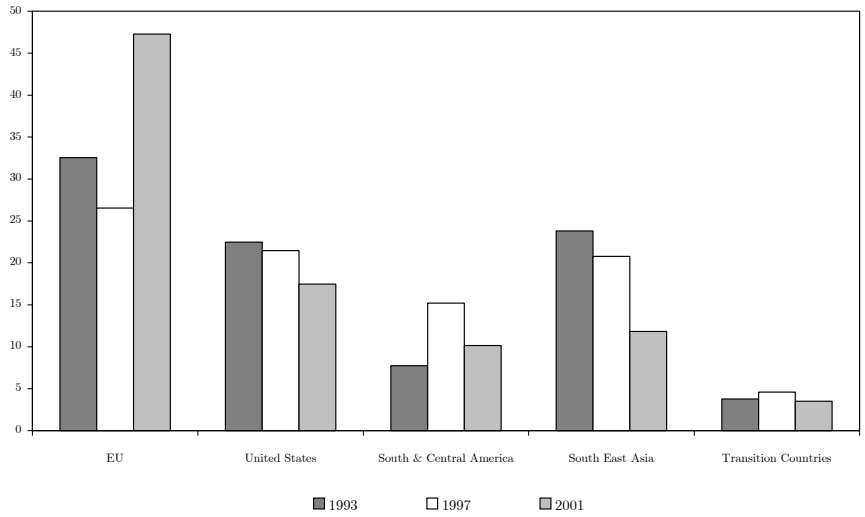

Figure 3.1: Percentage of total world inward FDI received by different regions (Source: own calculations based on UNCTAD)

transition countries, since their share of total FDI has been small, yet relatively stable throughout the last decade (*cf.* the continuous increase in table 3.1).

Absolute FDI inflows into transition countries have risen steadily since the start of transition as can be inferred from table 3.1. At the same time there has been substantial variation across countries. From figure 3.2 one can infer that countries in Central and Eastern Europe have received the bulk of FDI inflows in the region. Poland, the Czech Republic and Hungary are the top receivers. The FDI flows into the countries of the former Soviet Union have been much smaller, except for Russia and some countries with abundant natural resources such as Azerbaijan and Kazakhstan. Therefore we restrict our attention to the ten accession countries, eight of which by now have joined the EU.

Already early in transition it became clear that most of the Central and Eastern European countries -in contrast to those of the former Soviet Union- were redirecting their economy towards Western Europe and the EU. Their increasing integration with the EU resulted in a stream of FDI flows from the EU. This stream reflects a continuous adjustment towards a desired equilibrium FDI stock by EU-countries in these newly emerging economies that almost since the start of transition have been expected to join the E(M)U sooner or later. Table 3.2 gives an overview of the importance of the EU coun-

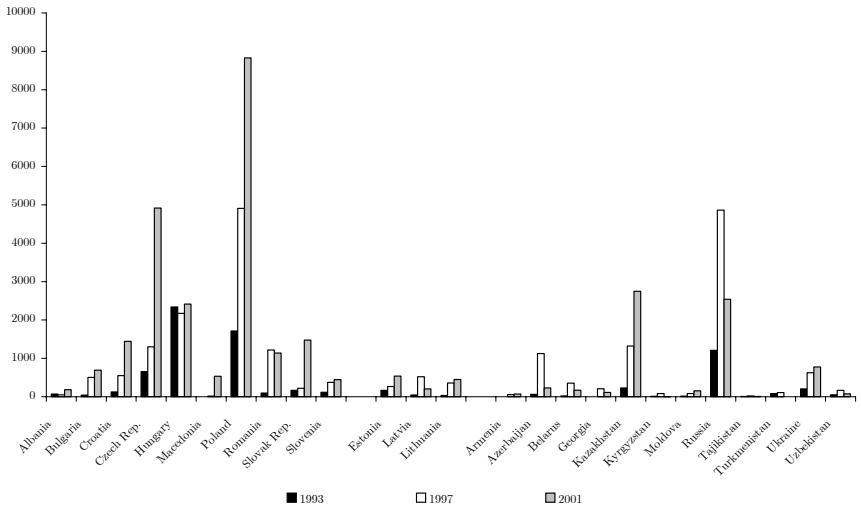

Figure 3.2: FDI Inflows in transition countries in selected years in bln. USD (Source: UNCTAD)

tries as source countries for inward FDI stocks in nine CEECs in 2000.[2] The EU accounts for about 80% of the stock of inward investment in most countries. The exceptions are Bulgaria, Latvia and Lithuania. For Bulgaria, other important source countries -apart from the US in the last line of table 3.2- are Cyprus (9.6%), Russia (6.7%), Switzerland (3.8%) and the Bahamas (3.7%). For Latvia, Estonia and Russia are the other important sources (11.2% and 6.0% respectively). In the case of Lithuania, FDI is spread out more equally. Switzerland, Norway, and Estonia are the larger source countries, all three accounting for about 5% of the inward FDI stock. Overall Germany is the most important investor in Central and Eastern Europe. The Netherlands are at least an equally important source for four of the more advanced transition countries (Czech Republic, Hungary, Poland, and Slovak Republic), but only play a minor role in the other countries. Austria is an important investor in its neighbouring countries. The Baltic States are strongly linked with Scandinavian countries. Denmark, Finland and Sweden account for nearly 70% of the FDI stock in Estonia, 30% in Latvia, and 42% in Lithuania.

Finally, table 3.3 presents macroeconomic figures for the year 2000 for the countries in our analysis. Poland has the largest inward FDI stock, followed by

[2]There were no data available for Romania.

Host / Source	Bulgaria 1999	Czech Republic 2000	Estonia 2001	Hungary 2000	Latvia 2000	Lithuania 2000	Poland 2000	Slovakia 2000	Slovenia 2000
Austria	5.6	11.1	0.2	12.2	0.5	0.7	3.3	14.5	45.6
Belgium	6.2	5.4	0.3	5.3	-	4.1	2.5	1.6	1.3
Denmark	0.1	1.2	3.4	0.5	10.5	18.3	2.5	-	1.5
Finland	-	0.6	25.4	1.6	6.2	6.0	0.6	-	-
France	2.7	4.3	0.9	6.5	-	1.1	12.5	3.2	10.7
Germany	19.3	25.5	2.6	25.8	11.1	7.4	19.0	28.7	12.5
Italy	1.7	0.8	0.6	2.7	0.1	0.2	4.4	1.5	5.4
Netherlands	3.7	30.1	4.0	22.5	2.8	1.1	26.1	24.4	3.0
Portugal	0.1	-	-	0.1	-	0.1	0.5	-	-
Spain	2.6	0.2	-	0.4	0.1	-	1.9	-	-
Sweden	0.3	1.4	39.5	0.9	12.6	17.3	3.5	-	0.5
UK	11.0	4.8	3.2	1.1	5.0	6.7	3.3	3.2	3.6
Total	53.3	85.4	80.1	79.6	48.9	63.0	80.1	77.1	84.1
US	12.0	6.5	9.5	8.2	9.4	9.8	9.6	6.8	3.9

Source: World Direct Investment Report

Table 3.2: Percentage of inward FDI stock in transtion countries originating from 12 EU-countries and the US

	(1) FDI stock	(2) FDI stock per capita	(3) GDP per capita	(4) Monthly gross wage	(5) Private sector share	(6) Country risk	(7) Transition index
Czech Republic	21644	2107	5423	342	80	61.67	3.3
Hungary	19804	1987	4636	319	80	63.54	3.6
Poland	34227	870	4300	347	70	62.63	3.4
Slovakia	4634	858	3752	246	80	50.70	3.1
Slovenia	2809	1413	9534	710	65	70.11	3.2
Estonia	2645	1898	3761	302	75	55.02	3.3
Latvia	2084	860	3250	236	65	52.60	2.9
Lithuania	2334	632	3252	252	70	50.45	3.1
Bulgaria	2716	398	1547	125	70	41.13	2.8
Romania	6480	290	1649	130	60	35.21	2.7

Inward FDI stock in millions of USD, UNCTAD FDI Database; FDI stock per capita in USD, UNCTAD FDI Database; GDP per capita in USD, World Economic Outlook Database, IMF; Monthly gross wages in manufacturing in euro, ILO Handbook of Labour Statistics; Private sector share in GDP, EBRD Transition Report; Country Risk, Euromoney magazine; Transition index: average of EBRD reform indicators, EBRD Transition Report.

Table 3.3: Overview of macroeconomic situation in 10 Central and Eastern European Countries

the Czech Republic and Hungary. The other countries are far behind in absolute figures. Looking at per capita figures the ranking changes. The Czech Republic and Hungary are still on top of the list, but Poland drops to fifth place, only just in front of Latvia and the Slovak Republic. Eyeballing columns 2 and 3 immediately suggests a positive relation between income and FDI stocks, lending some credibility to the market seeking hypothesis. The FDI per capita figures further reveal that Bulgaria and Romania are the worst performers. This can be related to the other columns in table 3.3: both countries are perceived as more risky than the others (see column 6, a higher score means a less risky country), and their transition index has fallen behind (column 7), which is also reflected by the somewhat smaller share of the private sector in GDP (column 5). This is a first indication that institutional development might be important to attract FDI. On the other hand, average gross monthly wages are much lower in Bulgaria and Romania (see column 4). *Ceteris paribus,* this should help them to attract more FDI, unless the lower wage levels correspond to lower productivity levels. Slovenian wages on the other hand are very high compared to the other countries.

3.3 A partial stock adjustment model

Given the state of development of an economy, there is an equilibrium level of foreign presence. We think of FDI flows as an adjustment process of the FDI stock towards this equilibrium. In a partial stock adjustment model *i*) the rate of growth of a variable Y is -*ceteris paribus*- proportional to the stock of Y and *ii*) the rate of growth is -*ceteris paribus*- proportional to an equilibrium value, Y^*. The law of growth of Y can be written as:

$$\frac{dY}{dt} = \kappa Y \left(Y^* - Y\right) \qquad 0 < \kappa < 1 \tag{3.1}$$

Some rewriting shows that the percentage rate of growth is a linear decreasing function of Y:

$$\frac{dY}{Y\,dt} = \frac{d\ln Y}{dt} = \kappa \left(Y^* - Y\right) \tag{3.2}$$

Chow (1967) indicates that an analytically more convenient expression is

$$\frac{d\ln Y}{dt} = \lambda\left(\ln Y^* - \ln Y\right) \qquad 0 < \lambda < 1 \tag{3.3}$$

$$\Leftrightarrow \quad \frac{dY}{dt} = \lambda Y\left(\ln Y^* - \ln Y\right) \tag{3.4}$$

The percentage rate of growth is now a linear decreasing function of $\ln(Y)$. The analytical convenience of the second formulation rests on the fact that we can replace (3.3) relatively easy by its discrete version.[3] The latter implies approximating the derivative of $\ln(Y)$ by $\ln(Y_t) - \ln(Y_{t-1})$ and the existing stock Y by Y_{t-1} (see Chow, 1967 and Cheng and Kwan, 2000).

Replacing Y with the FDI stock, we obtain

$$\frac{d\ln FDI_{i,t}}{dt} = \alpha\left(\ln FDI_i^* - \ln FDI_{i,t-1}\right) \tag{3.5}$$

$$\frac{dFDI_{i,t}}{dt} = \alpha FDI_{i,t}\left(\ln FDI_i^* - \ln FDI_{i,t-1}\right) \tag{3.6}$$

(3.5) says that the percentage change of the FDI stock is proportional to the gap between $\ln FDI_i^*$ and $\ln FDI_{i,t-1}$. Since $d\ln FDI_{i,t} = dFDI_{i,t}/FDI_{i,t}$, we can infer from (3.6) that the rate of change of the FDI stock is proportional to the existing stock, holding the gap constant. Here we assume that the equilibrium level, FDI_i^*, is unaffected by $FDI_{i,t}$.[4] In the absence of other constraints, the equilibrium level of the FDI stock would otherwise be either zero or infinity. The term $\ln FDI^* - \ln FDI_{i,t-1}$ implies that the self-reinforcing effect of $FDI_{i,t}$ diminishes as the actual stock approaches the equilibrium stock. It thus captures a process of gradual adjustment towards the equilibrium stock

[3] The solution to the differential equation (3.1) results in the so-called logistic curve, while the solution of the differential equation (3.4) gives the so-called Gompertz or loglog curve. In further stages of the process, i.e. for larger values of Y, a given increment in Y will dampen the rate of growth more for the logistic hypothesis than for the Gompertz hypothesis and the Gompertz rate of growth will be closer to a constant than the logistic rate of growth. A further difference between the two formulations arises in terms of the point where the maximum growth rate is reached. By setting derivatives with respect to Y equal to zero, one can infer that the maximum growth rate occurs at $Y = 0.5Y^*$ for the logistic case and $Y = e^{-1}Y^* = 0.37Y^*$ for the Gompertz case. Furthermore the growth driven by (3.2) is symmetric around $0.5Y^*$, while the decline in the Gompertz case is much more gradual. Although this is more in line with adjustment processes in reality, the main reason to prefer the Gompertz formulation is its analytical convenience.

[4] In order to have agglomeration effects the opposite should hold.

and is in line with the investment literature, which argues that the desired capital stock is attained gradually rather than instantaneously (Cheng and Kwan, 2000). The actual path of adjustment is thus the result of the interaction of the positive feedback effect with the distance between the FDI stock and its equilibrium.

For empirical purpose we switch to the discrete version of (3.5) and approximate the derivative of $\ln(FDI_{i,t})$ by $\ln(FDI_{i,t}) - \ln(FDI_{i,t-1})$. With $fdi_{i,t} = \ln(FDI_{i,t})$ we have

$$fdi_{i,t} - fdi_{i,t-1} = \alpha(fdi_i^* - fdi_{i,t-1}) \quad (3.7)$$

$$fdi_{i,t} = (1-\alpha) fdi_{i,t-1} + \alpha fdi_i^* \quad (3.8)$$

From (3.8) we can infer that the observed FDI stock at time t reflects the impact of two driving forces. First, the 'positive feedback' effect propels the stock towards its equilibrium level, even without changes in other determinants. Note that for the process to be stable $(1-\alpha)$ needs to be a positive fraction. Second, during the course of transition the determinants of the equilibrium level of FDI have changed. Consequently, the equilibrium level itself must also have shifted over time, and should get a time indicator, i.e. $fdi_{i,t}^*$.

In order to be able to estimate (3.8) we need to specify the determinants of equilibrium FDI. According to the type of FDI different factors might be decisive for the choice of location. Resource seeking investors will be attracted to locations with *ceteris paribus* low labour costs and good access to transport possibilities to the relevant markets. For market seeking investors local demand factors will be more important. Other factors might matter to both types of investors. Generally, any factor that affects the relative profitability of an investment location will also determine the equilibrium level of FDI. The importance of the following variables has been highlighted by earlier work[5]: the market size of the host country, the country's openness to trade, wage costs adjusted for the quality of labour, and the riskiness of a location (specially for emerging markets). Chakrabarti (2001) performed an extreme bound analysis for a large cross-section of countries and found strong support for the

[5] See e.g. Bevan and Estrin (2000), Bevan *et al.* (2004), Carstensen and Toubal (2004), Chakrabarti (2001) and references therein, Cheng and Kwan (2000), Garibaldi *et al.* (2001), Holland and Pain (1998), Kinoshita and Campos (2003), and Resmini (2000).

explanatory power of host country market size. Other determinants are more sensitive to the conditioning information set. Chakrabarti (2001) further finds that a country's openness to trade, followed by wage costs, is more likely to be correlated with FDI than other determinants.

The specific nature of the transition process brings along some further less standard determinants. First of all the key institutions underlying a market economy had to be put in place. Since the speed and approach of the institutional development differed widely among CEECs, institutional development may have constituted a decisive factor in the location choice of foreign investors in the region. Because of this variation in institutional development, transition countries make an ideal environment to test the impact of institutional development on FDI-patterns. Especially the privatization of state-owned enterprises stands out as an institutional change that is very likely to have borne a considerable impact on FDI. The methods of privatization varied widely across countries and embodied substantial differences in the openness of the process to foreigners. Three broad categories of privatization methods can be distinguished, namely insider, voucher and direct sales privatization. Insider privatization is not conducive to foreign investment as the local firm is 'sold' to a combination of management and employees. These insiders have been very reluctant and slow to transfer their controlling powers to outside owners (see for example Filatotchev *et al.*, 1999, for Russia). Voucher privatization allows citizens to trade vouchers (which they received for free) for shares in companies at primary privatization auctions. Citizens can do so directly or via intermediaries (for example the investment funds in the Czech Republic). In a later phase foreign investors can then buy shares from the new private owners on the secondary market. Direct privatization sales where state firms are sold for cash to the highest bidder have in general been most open to foreign participation. In many cases foreigners had equal access to the auctions, or even were explicitly targeted as potential bidders as was the case in Hungary (see State Audit Office, Hungary, 2001 for an overview of the role of foreigners in Hungary's privatization process).

Finally, during the 1990s, the Member States of the European Community and later the EU involved the countries of Central and Eastern Europe in an accession process. Since EU membership implies certain standards in terms of macroeconomic stability, institutional and legal environment and political

stability, the key announcements in the EU accession process may also have affected foreign investment. For example, lowered trade barriers between accession countries and the EU might be relevant for resource seeking investment.

3.4 Data and estimation procedure

The dataset contains bilateral FDI stocks in billions of 1996 EUR. The host countries are the eight new member states of the EU[6], Bulgaria and Romania. The source countries are twelve of the current EU member states.[7] The data are drawn from the European Union Foreign Direct Investment Yearbook 2001 supplemented with data from the OECD International Direct Investment Statistics Yearbook**.** We do not have data for all possible country pairs and end up with 99 combinations. The data period covered is 1992-2000 for most of the cross-sections, but not for all. Depending on the explanatory variables used the total number of observations is about 600.

As measure for market potential we use real GDP in EUR, calculated as GDP in USD multiplied by the euro-dollar exchange rate, deflated by euro prices. These series are drawn from the IMF International Financial Statistics database (IFS). The cost of labour in the host countries is measured by average monthly wages in manufacturing, converted to euro. Average monthly wages are obtained from the ILO handbook of labour statistics, exchange rates are taken from IFS. Given a certain discrepancy in labour quality across countries wage levels are probably not the right criterion for investors and should be corrected for the quality of labour. One may argue that foreign firms will be interested in wage levels rather than in unit labour costs because they bring their own productivity enhancing technology with them. Unit labour costs, however also reflect how well workers will be able to cope with for example new machinery. Therefore we consider unit labour costs as an alternative to wages. Unit labour costs are calculated as average monthly wages divided by productivity, in turn calculated as GDP divided by employment. The latter again is taken from IFS. We expect a negative impact of unit labour costs. Given that we consider bilateral flows, we further transform the variable by

[6] Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia.

[7] Austria, Belgium, Denmark, Finland France, Germany, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom.

making the ratio of host country unit labour costs to source country unit labour costs. Since we expect the ratio to be smaller than one, the larger it is, the smaller the difference between host and source country unit labour costs.[8] As the ratio gets bigger, FDI should decrease. The expectation of a negative sign therefore remains valid.

Gravity models of international trade suggest that the distance between two countries can serve as a proxy for transportation (and informational) costs. The smaller the distance, the larger the expected trade volume between two countries. With respect to FDI, distance between host and source may reflect opposing effects. The greater the distance, the more incentives there are to relocate production facilities to the host country and to replace exports with FDI. However, in case of resource seeking FDI with the intention of exporting from the host to the source country distance will have the opposite effect. Therefore we abandon distance and introduce bilateral trade between host and source country as explanatory variable. This variable, labelled integration, is exports from source to host plus imports by source from host as a percentage of host country GDP. Bilateral exports and imports are taken from the IMF Direction of Trade Statistics. The variable measures the importance of the source country as trading partner for the host country and reflects the degree of integration with individual (old) EU-members. At the same time it also controls for the size of the source country, since other things equal the host country will have more bilateral trade with a larger source country. A significant positive coefficient indicates that for source countries that are more important trade partners, the FDI stock of the source in the host is likely to be larger. Note that the variable has little to say about whether FDI and trade are substitutes or complements. Moreover, the substitution-complementarity issue is likely to differ across industries (Lipsey, 1991): complementarity stems primarily from increases in demands for intermediates in vertical relationships, and substitution emerges from trade displacement among final goods.

Investment decisions in emerging markets are also influenced by country risks. Risk ratings are provided on demand by specialized firms. These ratings are quite comprehensive and cover a broad range of underlying economic and political performance indicators. To the extent that we control for these factors in the regression, risk perception should no longer matter. Nevertheless it is

[8] Should the ratio be larger than one, the opposite would hold.

interesting to see whether these ratings add to the explanatory power of our regressions. We use the average of the country risk ratings published twice a year by Euromoney. Because a higher value indicates less risk, a positive relation with FDI inflows can be expected. In the specific case of transition countries the perceived country risk is highly correlated with progress in reform. Resmini (2000) concludes that the path and the pace of structural reforms have been crucial for attracting FDI (her sample covers 1990-95). According to Kinoshita and Campos (2003) trade liberalization and a reduction in capital controls are most relevant to foreign investment among all the available indices of structural reform. If trade is positively associated with FDI, a more liberal trade regime will induce FDI. On the other hand, if FDI is motivated by avoiding trade restrictions, reduction of these restrictions will not induce more FDI. Restrictions to currency convertibility hamper import of inputs and repatriation of profits, phenomena that typically come along with FDI. In the empirical analysis we test for an effect of the progress in different areas of reform. In order to do so, the liberalization indicators taken from the yearly Transition Report, issued by the European Bank for Reconstruction and Development (EBRD), are added to the regressors. With respect to progress in the privatization process we use more detailed measures than the liberalization indicator from the Transition Report. We use separate indices for insider, voucher and direct privatization. The variables take the value 1 if the method concerned was the primary privatization method in a given year, 0.5 if it was the secondary, and 0.25 if was the tertiary method.[9] The indicator takes into account whether privatization actually occurred or not. The data are taken from Garibaldi *et al.* (2001), and are updated with information from several recent issues of the Transition Report.

The time-varying equilibrium level of FDI, $fdi^*_{i,t}$ can then be written as

$$fdi^*_{i,t} = \beta' X_{i,t} \tag{3.9}$$

[9] For example in given year in specific country direct sales were commonly used for privatization, but also some voucher schemes were applied. *Direct* would then be 1, $Voucher$ 0.5, and $Insider$ 0. Should only direct sales have been used, *Direct* would be 1, $Voucher$ 0, and $Insider$ 0. If no privatization took place, all three variables equal zero. For a given year and a given country, it is not possible that 2 variables obtain the same score, except zero.

where $X_{i,t}$ is a vector of the determinants of $fdi^*_{i,t}$ discussed above. Substituting in (3.8) gives

$$\begin{aligned} fdi_{i,t} &= (1-\alpha)\, fdi_{i,t-1} + \alpha\beta' X_{i,t} \qquad (3.10) \\ &\Leftrightarrow \quad fdi_{i,t} = \alpha\left(\beta' X_{i,t} - fdi_{i,t-1}\right) + fdi_{i,t-1} \end{aligned}$$

This is equivalent to the following error-correction representation where the imposed restriction follows from the assumption of the partial stock adjustment model.

$$\Delta fdi_{i,t} = \alpha\left(\beta' X_{i,t-1} - fdi_{i,t-1}\right) + \alpha\beta'\Delta X^*_{i,t}$$

For estimation we consider the following reparametrisation of (3.10). This is a dynamic panel regression with a lagged dependent variable on the right-hand side.

$$\begin{aligned} fdi_{i,t} &= \delta fdi_{i,t-1} + \gamma' X_{i,t} + u_{it} \qquad (3.11) \\ u_{it} &= \eta_i + \nu_{it} \end{aligned}$$

The OLS estimator of (3.11) is inconsistent because the lagged dependent variable is positively correlated with the error term $(\eta_i + \nu_{it})$ due to the presence of the individual effects. Though the within estimator eliminates this source of inconsistency by transforming the equation to eliminate η_i, it introduces a non-negligible correlation between the transformed lagged dependent variable and the transformed error term. This then gives rise to a new source of inconsistency (see Nickell, 1981). Arellano and Bond (1991) propose to apply a GMM-estimator on the first-differenced version of (3.11).

$$\Delta fdi_{i,t} = \delta\Delta fdi_{i,t-1} + \gamma'\Delta X_{i,t} + \Delta u_{i,t} \qquad (3.12)$$

where the cross-section specific effects are eliminated by first-differencing. The transformed specification suggests an instrumental variables approach. $fdi_{i,t-2}$ is correlated with $fdi_{i,t-1} - fdi_{i,t-2}$, but not with $\Delta u_{i,t} = \nu_{i,t} - \nu_{i,t-1}$ under the assumption of no autocorrelation in the level residuals.[10] Provided $T \geq 3$, the two period lagged level of the dependent variable can be used

[10] The only further assumption required is that the initial conditions fdi_{i1} are uncorrelated

to identify α. Arellano and Bond (1991) suggest the following extended list of instruments for the first-differenced equations. More precisely, rather than using only $fdi_{i,T-2}$ as instrument for the first-differenced equation in period T, $fdi_{i1}, fdi_{i2}, ..., fdi_{i,T-2}$ are available as instruments.

$$E\left(fdi_{i,t-s}\Delta\nu_{it}\right) = 0 \quad t = 3, ..., T \text{ and } s \geq 2 \tag{3.13}$$

In the case of multivariate analysis the explanatory variables can be used as additional instruments. For strictly exogenous variables x, both past and future values are valid instruments. In the case of reverse causality, x is said to be only weakly exogenous or predetermined. Then only suitably lagged values of x qualify as valid instruments. This gives rise to the following moment conditions. For the strictly exogenous variables, $e_{i,t-s}$, in $X_{i,t}$

$$E\left(e_{i,t-s}\Delta\nu_{it}\right) = 0 \quad t = 3, ..., T \text{ and all } s \tag{3.14}$$

and for predetermined variables, $p_{i,t-s}$, in $X_{i,t}$

$$E\left(p_{i,t-s}\Delta\nu_{it}\right) = 0 \quad t = 3, ..., T \text{ and } s \geq 2 \tag{3.15}$$

The first-differenced GMM estimator has been found to have poor finite sample properties (bias and imprecision) when the lagged levels of the series are only weakly correlated with subsequent first differences, so that the instruments available for the first-differenced equations are weak (Blundell and Bond, 1999). This is the case in our dataset as the correlation between $\Delta fdi_{i,t}$ and $fdi_{i,t-1}$ is only -0.36.[11] Blundell and Bond (1998) suggest to augment the first-differenced moment conditions by the following level moment conditions to improve the efficiency of the GMM-estimator.

$$E\left(\left(\eta_i + \nu_{it}\right)\Delta fdi_{i,t-1}\right) = 0 \quad \text{for } t = 3, ..., T \tag{3.16}$$

Level moment conditions for the explanatory variables can be added accord-

with the subsequent disturbances, i.e.

$$E\left(fdi_{i1}\nu_{it}\right) = 0 \text{ for } i = 1, ..., N \text{ and } t = 2, ..., T$$

[11] The correlation for the main explanatory variables is: -0.07 for GDP of the source country, -0.28 for relative unit labour costs, and 0.21 for the integration variable.

ingly:

$$E\left(\left(\eta_i + \nu_{it}\right)\Delta e_{i,t-s}\right) = 0 \quad t = 2, ..., T \text{ and all } s \tag{3.17}$$

for strictly exogenous x, and for predetermined x

$$E\left(\left(\eta_i + \nu_{it}\right)\Delta p_{i,t-s}\right) = 0 \quad t = 3, ..., T \text{ and } s \geq 1 \tag{3.18}$$

The GMM estimation based on the moment conditions (3.13)-(3.18) can be performed in one step or in two steps. The difference between both estimators is that the one-step estimator is asymptotically efficient only under homoskedasticity of the ν_{it}, while two-step estimator does not require homoskedasticity to be asymptotically efficient. Nevertheless, a lot of applied work has focused on the one-step GMM estimator rather than the two-step version because the two-step weight matrix depends on estimated parameters. This makes the usual asymptotic distribution approximations less reliable for the two-step estimator. Simulation studies have shown that the asymptotic standard errors tend to be much too small. Equivalently the asymptotic t-ratios are much too big when using the two-step estimator, whereas the equivalent tests based on the one-step estimator are quite accurate. Windmeijer (2000) provides a formal analysis of the issue, and proposes a finite sample correction for the asymptotic variance of the two-step GMM estimator. We use the two-step estimator and present corrected standard errors.[12]

The overall validity of the moment conditions is checked by the Hansen test of overidentifying restrictions. The null hypothesis of no misspecification is rejected if the minimized GMM criterion function registers a large value compared with a χ^2-distribution with the degree of freedom equal to the difference between the number of moment conditions and number of parameters. The key identifying assumption that there is no serial correlation in the ν_{it} disturbances can also be tested. If the level residuals are indeed serially uncorrelated, then, by construction, the first-differenced residuals in (3.12) would follow an MA(1) process which implies first-order autocorrelation, but no higher order autocorrelation. Based on the first-differenced residuals, the Arellano-Bond *m1* and *m2* statistics test the null hypotheses of zero first- and second-order

[12] In a comparable analysis Carstensen and Toubal (2004) present highly significant coefficients. As they do not deal with the issue of the standard errors, some caution may be warranted.

autocorrelation, respectively (see Arellano and Bond (1991) for further details). An insignificant *m1* or significant *m2* will issue warnings against the likely presence of invalid moment conditions due to serial correlation in the level residuals.

3.5 Empirical results

Tables 3.4, 3.5, 3.6, and 3.7 contain the empirical results. The tests for first and second order autocorrelation and the Hansen test for overidentifying restrictions are satisfactory in all cases. We do not report p-values for the *m1*-test because they are all smaller than 0.01. The displayed coefficients in the tables are based on the reparametrisation in (3.11) and thus show δ and γ'. To interpret the estimated coefficients in the original model we need to perform some recalculations. To derive the speed of adjustment, α, we subtract the estimated coefficient of lagged FDI ($\delta = 1 - \alpha$), from 1. In order to retrieve the impact of the determinants on the equilibrium level of FDI, i.e. β's in (3.9), the estimated coefficients γ' ($= \alpha\beta'$; *cf.* (3.11)) are divided by 1 minus the coefficient of lagged FDI ($1 - \delta = \alpha$). Below, we interpret results in terms of the original framework and the impact of the variables is calculated accordingly. Table 3.4 contains a set of basic results with the traditional determinants of FDI included among the explanatory variables. In table 3.5 we present a more detailed analysis of the impact of privatization strategies on FDI. Table 3.6 is concerned with the effect of different institutions. And finally, table 3.7 presents some additional robustness checks.

3.5.1 Basic results

Table 3.4 contains a first set of results. Specification [1] presents results for the more traditional model. In addition to the lagged FDI stock, following from the partial adjustment specification, we use four variables as determinants of the equilibrium stock: GDP, relative unit labour costs, the risk indicator, and the integration variable. From specification [1] in table 3.4 we see that the lagged FDI stock is statistically significant in explaining the current FDI stock. The point estimate of 0.75 implies an adjustment speed of 0.25. Specifications [2] to [9] result in an adjustment speed of about 0.3. The latter value implies an

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
FDI_{t-1}	.750	.702	.700	.709	.712	.698	.704	.693	.699
	(20.88)	(15.86)	(16.06)	(17.34)	(17.63)	(16.34)	(17.65)	(14.46)	(16.15)
GDP_t	.317	.364	.367	.325	.349	.324	.349	.365	.384
	(4.98)	(4.63)	(4.74)	(4.19)	(4.90)	(4.37)	(4.87)	(4.40)	(5.36)
$Integration_t$	.024	0.29	.028	.026	.028	.029	.029	.029	.029
	(4.06)	(4.17)	(4.29)	(4.34)	(4.37)	(4.72)	(4.57)	(3.82)	(4.38)
Relative unit	-.614	-.724	-.790	-.765	-.743	-.771	-.741	-.863	-.908
$labour\ cost_t$	(-1.93)	(-1.93)	(-2.14)	(-2.33)	(-2.29)	(-2.31)	(-2.32)	(-2.28)	(-2.35)
$Risk_t$	.153	.149	.156	.146	.144	.156	.143	.174	.033
	(2.46)	(2.17)	(2.27)	(2.46)	(2.33)	(2.43)	(2.25)	(2.54)	(0.21)
Privatisation									
$insider_t$		-.124							
		(-1.31)							
$voucher_t$		-.137							
		(-1.46)							
$direct_t$		.195	.215	.199	.188	.218	.178	.192	.201
		(2.21)	(2.50)	(2.24)	(2.15)	(2.52)	(2.17)	(2.06)	(2.33)
$nondirect_t$			-.145	-.065	-.082	-.064	-.068	-.154	-.163
			(-2.00)	(-0.91)	(-1.27)	(-0.81)	(-1.05)	(-2.13)	(-2.17)
Extra market				.017	1.666	.018	3.905		
$potential_t$†				(1.04)	(0.58)	(1.92)	(1.67)		
EU accession									
Essen									.527
									(0.83)
Agenda 1								.073	
								(1.23)	
Agenda 2								.033	
								(0.46)	
N	627	627	627	627	627	627	627	627	627
M1	-4.05	-3.93	-3.89	-3.89	-3.92	-3.87	-3.90	-3.83	-3.93
M2	-1.13	-1.10	-1.10	-1.08	-1.09	-1.13	-1.12	-1.15	-1.05
	(0.26)	(0.27)	(0.27)	(0.28)	(0.28)	(0.26)	(0.26)	(0.25)	(0.29)
Hansen χ^2	93.32	93.34	93.55	91.51	93.67	95.23	91.25	93.64	93.47
	(0.64)	(0.64)	(0.64)	(0.97)	(0.96)	(0.95)	(0.97)	(0.63)	(0.63)

†Extra market potential: [4] sum of GDP of neighbouring countries; [5] distance weighted sum of GDP of neighbouring countries; [6] 'infrastructure' weighted sum of GDP of neighbouring countries; and [7] distance and 'infrastructure' weighted sum of GDP of neighbouring countries;

Table 3.4: Basic results

adjustment path as shown in figure 3.3 where the equilibrium value is assumed to be 5.02[13] and the starting value is set at zero. The adjustment is quite rapid and after five periods about 80% of the initial gap is closed already.[14] As equilibrium is quickly reached our focus on the determinants of the equilibrium FDI stock is warranted.

The significant positive impact of GDP suggests that the market access mechanism is present. A 1% increase in GDP results in an increase of 0.317/(1-0.75)=±1.27% of the equilibrium FDI stock. The integration variable is statistically significant and is positively signed. An increase in trade intensity

[13] This is about the average value of the natural logarithm of the stock of FDI for the period 1995-2000 for the average bilateral country pair. This makes EUR 148.4 billion.

[14] A solution to $fdi_{t+1} - (1-\alpha)\, fdi_t = \alpha fdi^*$ is $fdi_t = A\,(1-\alpha)^t + fdi^*$. For the initial level at $t = 0$ we have $fdi_0 = A + fdi^*$. The initial gap thus equals A. The gap will be halved when $fdi_t - fdi^* = \frac{1}{2}A$. With $\alpha = 0.3$ this is the case after 1.94 period.

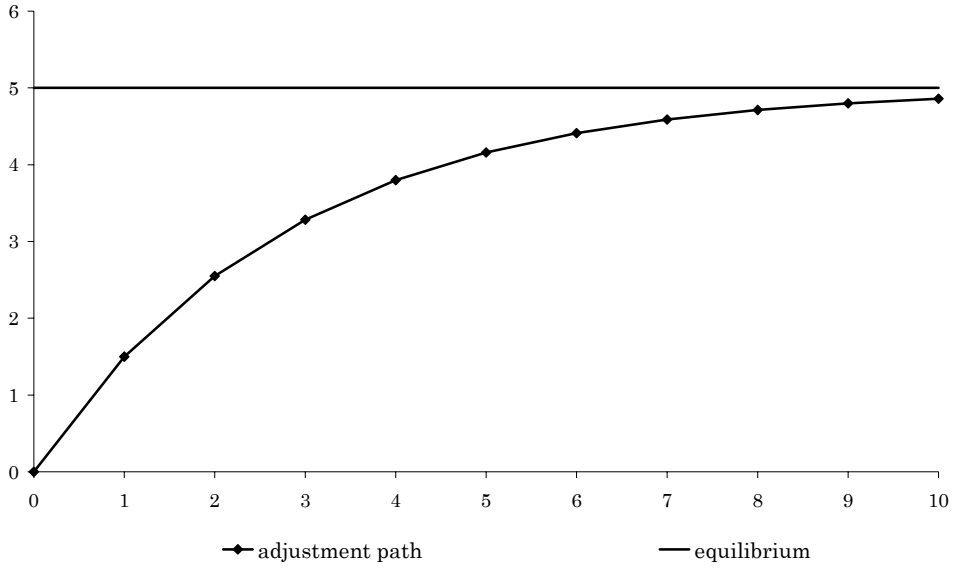

Figure 3.3: Adjustment path towards the time-invariant equilibrium

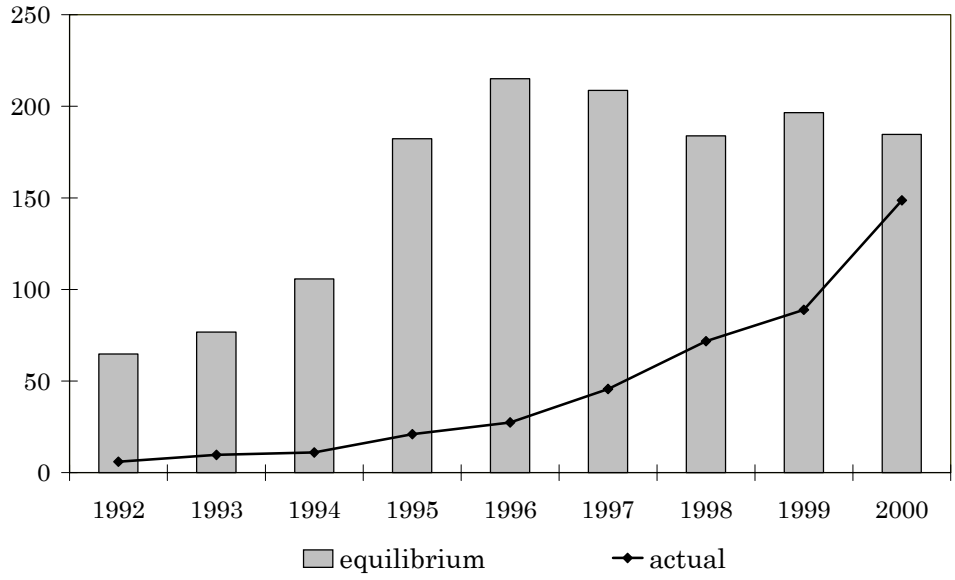

Figure 3.4: Actual average FDI stock and equilibrium FDI stock implied by [1] in table3.4 (billions of EUR)

between host and source is accompanied by an increase in the FDI stock of the source in the host. An increase of 10%-point in trade integration is associated with an increase of about 0.96% of the FDI stock. Relative unit labour costs have the expected impact. As the gap between host and source country unit labour costs becomes smaller, i.e. an increase in the relative unit labour costs, the FDI stock is negatively affected. If for example the relative unit labour costs increase from 0.4 to 0.5, the equilibrium FDI stock decreases with 0.24%. The risk variable is significant and has the expected sign. An increase in the risk variable with 1%, i.e. a reduction of the risk, increases the FDI stock with about 0.612%. Figure 3.4 plots the actual FDI stock and the equilibrium implied by specification [1] for the average bilateral country pair. The equilibrium stock increases rapidly to about EUR 200 bln. and falls back a little to stabilise around EUR 185-190 bln..

In [2] we add the privatization strategy used by the host country to the explanatory variables. We consider three categories of privatization: direct, voucher and insider privatization. Direct privatization has a significant positive impact on FDI, whereas insider and voucher privatization are negative but not significant. Because point estimates are not that different we reran the regression combining voucher and insider privatization into the category non-direct privatization. Specification [3] seems to suggest that countries that used a non-direct method as primary strategy on average have a logarithmic current equilibrium FDI stock that is 0.58 lower, or a stock that is 1.79 billion EUR lower. Alternatively, this can be interpreted that non-direct privatization as secondary method reduces the positive impact of the direct strategy that has been used as primary method. Though significant here, further results cast some doubt on the robustness of this finding.

Specifications [4] to [7] test for an additional dimension of a country's market potential. In [4] and [5] we add the sum of the GDPs of the neighbouring transition countries to the other left hand side variables, the difference between [4] and [5] is that in [5] the respective GDPs are weighted by the inverse of the distance between the host country capital and the neighbour countries' capitals. While the conclusions with respect to the core variables arising from [3] remain unaffected, the extra market potential does not seem to add to a country's attractiveness. In [6] and [7] we use infrastructure as an additional weight to determine the potential arising from neighbouring countries. Infrastructure

is defined as the ratio of kilometres of paved roads over country surface. The underlying assumption is that countries that are connected through a better road network are more easily accessible and therefore constitute a bigger market potential. In [6] the infrastructure weighted GDP of neighbouring countries is significant at the 5%-level. In [7] the distance and infrastructure weighted additional market potential is significant at the 10%-level. The main conclusions with respect to the other variables are unaffected.[15]

Finally, in [8] and [9] we introduce EU integration announcement variables. The variables AG1 and AG2 in [8] reflect the division between first and second wave accession countries, identified in the Agenda 2000 document of the European Commission. The decision was taken at the Amsterdam 1997 IGC. AG1 is a dummy variable that takes the value 1 in the period 1997-99 for the first wave countries, AG2 is defined along the same lines but for second wave countries.[16] Both variables are not statistically different from zero. Noteworthy is that AG1 is much larger and closer to significance than AG2. The ESSEN-variable in [9] reflects the launch of the pre-accession strategy at the Essen European Council in December 1994. The variable takes the value of 1 from 1995 onwards. As can be seen from table 3.4, we neither find a significant impact for this variable. This is in line with Bevan and Estrin (2000) who find no announcement effects for the level of FDI. Only after switching to changes in inflows and considering only announcement effects for Visegrad countries they find some impact. Does this mean that EU integration bore no effect at all on FDI? Clearly not, EU integration probably affected institutional development (think of the Copenhagen criteria). Moreover in this sample we only have data on accession countries and no other transition countries that integrated less with the EU.[17] Furthermore, almost immediately after the start of transition it became clear that the countries of Central and Eastern Europe would, if not join the EU, than at least focus on the EU-countries as main trading partners and ease trade relations with the EU. Therefore our panel may be too limited

[15] We also tested the EBRD index of trade and foreign exchange, import duties, and taxes on international trade as other possible weights along the lines of infrastructure. These were never significant but again left the core (qualitatively) unaffected.

[16] The first wave countries are the Czech Republic, Estonia, Hungary, Poland, and Slovenia; the second wave roup consists of Bulgaria, Latvia, Lithuania, Romania, and the Slovak Republic. In 2000 eight of the ten applicants were announced to be entering the EU in 2004. The difference between first and second wave then disappears. Bulgaria and Romania will enter the EU in a later stage.

[17] This is also the case in Bevan and Estrin (2000).

to observe an effect.

3.5.2 FDI and privatization

In table 3.5 we investigate the relationship between privatization and FDI more thoroughly. Since most of the enterprises were state-owned at the outset of transition, their privatization potentially offered opportunities for brownfield FDI. A broad array of privatization techniques was used across countries. During transition, countries switched methods or used combinations of methods. As we confirmed in table 3.4 not all methods allowed for FDI equally well. Clearly, not only current privatization efforts bear an impact on the equilibrium stock, but the entire history of the privatization process is likely to influence the current (equilibrium) level of the FDI stock. Therefore we introduce the cumulative direct and non-direct indices, one period lagged to account for history. From [1] in table 3.5 one can infer that both the direct and non-direct privatization history have a significant positive impact. Since we cannot reject their impact to be equal, we re-estimate with [2] as result. Privatization history, independent from the method used, has a positive impact on the FDI stock. This probably reflects that privatization is only the first step in a series of changes in ownership, so that eventually the opportunities for foreigners to invest are no longer related to the privatization method used. This is in line with the findings of Frydman *et al.* (1996) that not the privatization method *per se*, but the resulting ownership type is decisive for firm performance.

The relationship between FDI and privatization may be even more complex. We did not find a concurrent impact of non-direct privatization. Nevertheless, voucher and insider privatization schemes may have served as a dissuasive signal, because they were partly induced by the fear of selling out to foreigners. This may lead foreign investors to postpone or even restrain them from their planned investment. Furthermore, non-direct methods resulted in natives owning the firms. Especially insider privatization resulted in a sort of entrenchment as insiders clung to the control over the firm and blocked restructuring. New investors will then also be less eager to invest because the scope for positive externalities from domestic firms is smaller. This suggests that rather than affecting the equilibrium itself, non-direct methods of privatization slow down the adjustment to the equilibrium. We test this by transforming (3.11) as fol-

	[1]	[2]	[3]	[4]	[5]
FDI_{t-1}	.628	.626	.654	.694	.642
	(11.57)	(11.86)	(13.24)	(10.75)	(11.81)
FDI_{t-1}*direct			-.007	-.011	
			(-0.32)	(-0.64)	
FDI_{t-1}*nondirect			-.038	-.023	-.041
			(-1.99)	(-2.07)	(-2.62)
GDP_t	.434	.432	.421	.407	.437
	(4.72)	(4.78)	(5.38)	(4.87)	(4.64)
$Integration_t$	.038	.037	.040	.036	.039
	(4.44)	(4.29)	(4.20)	(3.62)	(3.91)
Relative unit labour $cost_t$	-1.189	-1.260	-1.316	-1.076	-1.180
	(-2.85)	(-2.85)	(-2.78)	(-2.36)	(-2.18)
$Risk_t$	.127	.150	.161	.110	.130
	(1.66)	(1.94)	(2.53)	(1.71)	(1.72)
Privatisation					
$direct_t$	.165	.199	.179	.218	.224
	(1.83)	(2.13)	(1.78)	(2.00)	(2.03)
$nondirect_t$	-.007	-.058	-.007	.016	-.027
	(-0.10)	(-0.74)	(-0.08)	(0.20)	(-0.33)
Cumulative $direct_{t-1}$	.062				
	(2.26)				
Cumulative $nondirect_{t-1}$	.057				
	(2.35)				
Cumulative direct-$nondir_{t-1}$		.055	.053	.052	.050
		(2.66)	(2.96)	(2.60)	(2.44)
N	579	579	579	579	579
M1	-3.70	-3.70	-3.73	-3.76	-3.64
M2	-1.10	-1.11	-1.18	-1.04	-1.19
	(0.27)	(0.27)	(0.24)	(0.30)	(0.24)
Hansen χ^2	91.60	93.94	93.50	92.79	93.77
	(0.69)	(0.62)	(0.95)	(0.95)	(0.60)

Table 3.5: FDI and privatisation schemes

lows, where we also allow for the possibility direct privatization schemes serves as a positive signal to foreign investors, speeding up adjustment to equilibrium.

$$\begin{aligned} fdi_{i,t} &= \delta\left(1+\kappa_1\ nondirect_{t-1}+\kappa_2\ direct_{t-1}\right)fdi_{i,t-1} \qquad (3.19)\\ &\quad +\gamma' X_{i,t}+\varepsilon_{it} \\ \Leftrightarrow\ & fdi_{i,t}=\delta fdi_{i,t-1}+\delta_{\kappa 1}\ nondirect_{t-1}fdi_{i,t-1} \qquad (3.20)\\ &\quad +\delta_{\kappa 2}\ direct_{t-1}fdi_{i,t-1}+\gamma' X_{i,t}+\varepsilon_{it} \end{aligned}$$

Columns [3] and [4] in table 3.5 present results. They confirm our hypothesis that the use of non-direct methods slows down adjustment. The point estimate is small but significant. The coefficient of lagged FDI varies between 0.6 and 0.7 and is reduced by about 0.04. Direct privatization does not seem to affect the speed of adjustment. Results with respect to the other variables remain unaffected. In column [4] we consider privatization strategies of the

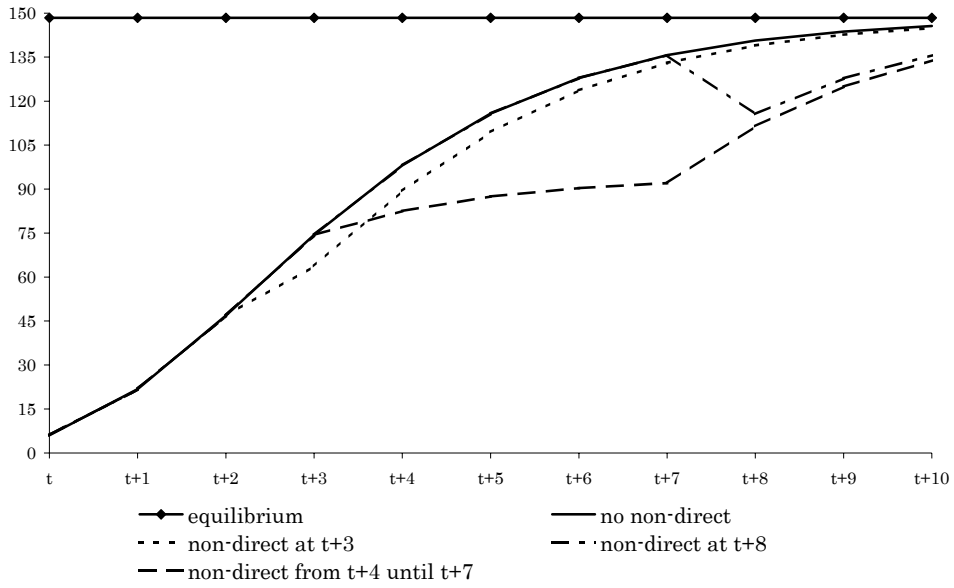

Figure 3.5: Impact of non-direct privatisation on the adjustment path to the time-invariant equilibrium

last 2 years, rather than just last year. The dampening impact on the speed of adjustment is now significant at the 5%-level. Since the no privatization observations are limited, the correlation between direct and non-direct is fairly high, therefore [5] excludes the impact of direct privatization on the speed of adjustment. The significance level of the interaction term increases to the 1%-level. Based on specification [3], figure 3.5 plots the impact of non-direct privatization in a given year or period on the adjustment path to a time-invariant equilibrium level of about EUR 148.4 bln. (*cf. supra*). The closer to the equilibrium the larger the impact. This can also be seen from (3.20): the impact is $\delta_{\kappa 1}\ nondirect_{t-1} fdi_{i,t-1}$. This implies that the impact on the adjustment path is related to the level of $fdi_{i,t-1}$. Now, the closer to the equilibrium, the higher $fdi_{i,t-1}$ will be. Hence, a larger impact when closer to the time-invariant equilibrium. Figure 3.5 further reveals that a prolonged period of non-direct privatization considerably slows down catch-up to the equilibrium.

Summarizing, our evidence suggests that current direct privatization has an immediate positive effect on the equilibrium level of FDI, while current non-direct privatization negatively slows down adjustment to equilibrium. Privatization history positively affects the equilibrium level of FDI independently

of the method used.

3.5.3 FDI and institutions

Following the increasing literature that relates institutions to economic outcomes, institutions increasingly are stressed as potential locational advantages (see e.g. Kinoshita and Campos, 2003, Bevan *et al.*, 2004). The risk variable already picked up the general institutional context to some extent. In the previous section we also elaborated on the complex relationship between FDI and privatization, one of the important institutional reform areas. However, the entire institutional framework of the socialist economies had to be rebuilt from scratch. This process resulted in wide variety of approaches across countries. The EBRD provides indicators of progress in different areas of institutional reform in its yearly Transition Report. This allows us to test which institutions matter to foreign investors and which not. We therefore replace the risk indicator with various indicators of reform. Since foreign investors face costs for adaptation to an incomplete institutional environment, we expect the forerunners to have attracted more investment.

In addition to the average level of reform we test for the impact of reform in the following areas: prices, trade and foreign exchange, competition policy, banking reform, and reform of non-banking financial institutions. Table 3.6 presents results for these different institutions. The average reform indicator used in column [1] is a simple average of the EBRD indicators, excluding the indicators for small and large scale privatization since we already extensively control for privatization efforts. We find a significant positive coefficient. An increase of 1% in the level of average reform is associated with an increase of 1.34% in the FDI stock. This points to the crucial role of the stage of development of institutions in attracting FDI, for in quantitative terms the point estimate of the coefficient implies a large positive contribution to FDI.

The creation of markets has been one of the core elements of the transition to a market economy. In this respect, the liberalization of prices in both domestic and international markets was one of the crucial reform steps. As foreign investors usually prefer to operate on competitive domestic markets, price liberalization creates new business opportunities for them. The abolition of exchange restrictions and multiple exchange rates allows to repatriate prof-

	[1]	[2]	[3]	[4]	[5]	[6]
FDI_{t-1}	.622	.680	.661	.670	.673	.691
	(12.13)	(13.58)	(12.22)	(12.10)	(14.33)	(13.02)
FDI_{t-1}*direct	-.011	-.019	-.002	-.010	-.016	-.012
	(-0.48)	(-0.84)	(-0.08)	(-0.46)	(-0.71)	(-0.48)
FDI_{t-1}*nondirect	-.039	-.042	-.037	-.042	-.041	-.043
	(-2.26)	(-2.58)	(-1.94)	(-2.29)	(-2.20)	(-2.28)
GDP_t	.423	.389	.422	.410	.429	.451
	(5.13)	(5.14)	(5.24)	(4.65)	(5.75)	(6.66)
$Integration_t$	.039	.037	.039	.039	.039	.038
	(3.82)	(3.72)	(4.01)	(3.62)	(4.39)	(3.68)
Relative unit Labour $costs_t$	-1.119	-1.663	-1.140	-.720	-.970	-.567
	(-2.37)	(-4.07)	(-2.71)	(-1.92)	(-2.30)	(-1.75)
Privatisation						
$direct_t$	.183	.127	.202	.242	.171	.302
	(1.90)	(1.26)	(1.94)	(2.35)	(1.60)	(2.58)
$nondirect_t$	-.009	-.025	.004	.027	-.019	.080
	(-0.11)	(-0.33)	(0.05)	(0.35)	(-0.24)	(0.93)
$cdirnondir_{t-1}$	.040	.044	.047	.039	.036	.051
	(2.18)	(2.36)	(2.60)	(1.88)	(2.05)	(2.18)
Institution†	.506	.912	.352	.301	.416	-.177
	(2.05)	(3.71)	(2.32)	(1.78)	(1.82)	(-0.80)
N	579	579	579	579	579	579
M1	-3.73	-3.85	-3.78	-3.72	-3.81	-3.79
M2	-1.07	-1.02	-1.03	-0.98	-1.18	-1.09
	(0.28)	(0.31)	(0.30)	(0.33)	(0.236)	(0.28)
Hansen χ^2	91.44	89.12	93.38	92.57	91.03	90.05
	(0.96)	(0.97)	(0.94)	(0.95)	(0.96)	(0.97)

† Institutions used in: [1] Average refom (excl. privatisation) ; [2] Price reform; [3] Trade & foreign exchange reform; [4] Competition policy reform; [5] Banking reform; and [6] Reform of non-banking financial institutions

Table 3.6: FDI and institutional development

its and reduces transaction costs.[18] For both price reform and trade & foreign exchange reform, we find strongly significant positive coefficients (see columns [2] and [3]). This reflects that it is more interesting to invest in markets that have been liberalized and where there is free competition. Further, bureaucratic interference in business transactions that is subject to clear rules and regulation reduces institutional uncertainty. This applies notably to competition policy, which is important to protect consumers but can also be (ab)used to inhibit foreign entry. Regulatory policy is of particular concern for investors in industries with incumbent national monopolists (for example telecommunications). As old monopolies are broken, new possibilities are offered to foreign investors. Initially neglected, the design and implementation of competition policy has proven to be a complex process, that lagged the liberalization of markets for goods and services. In addition to the mere existence of rules, en-

[18] Established foreign-owned firms that benefit from barriers to entry, however, will oppose this type of reform.

forcement is necessary as well. Weak enforcement of regulatory policies tends to favour incumbent firms or firms with access to political and bureaucratic decision makers. Changes in competition policy therefore may change the relative competitiveness of firms operating in a given market and thus provide opportunities for entry of foreign firms with a competitive advantage. The results in [4] show a positive effect of improvements in competition policy. It is significant at the 10%-level.

Progress in establishing financial infrastructure and capital markets facilitates access to complementary local financing for foreign investors and reduces transaction costs for local financial services. Further, better access to local finance helps to reduce the exposure to the exchange rate risk. A better financial architecture reduces the risk concerning the stability of the payment system and the risk of a banking crisis. Local customers are also more likely to gain access to bank credit. This can accelerate demand for goods that are often bought on credit, e.g. up-market consumer durables. Financial reform should thus increase business opportunities for foreign investors. We find that banking reform in [5] is significant at the 10%-level. A smoother working financial sector thus seems to increase the attractiveness of a location. Reform of non-banking financial institutions, on the other hand, is of no importance to foreign direct investors as appears from [6].

3.5.4 Robustness

We make a final round of robustness checks by replacing some of the core variables with suitable proxies. In column [1] of table 3.7 we replace our comprehensive risk indicator with its subcomponent that only reflects political risk. Our previous results are confirmed. We already indicated that the risk variable to a large extent accounts for progress in the transition to a market economy as well. In table 3.6 we tested the effect of progress in different reform areas on FDI. In column [2] of table 3.7 we propose another variable that proxies progress in market reform. The private sector share in GDP (taken form the EBRD Transition Reports) not only measures progress in reform but probably introduces a further element in the sense that investors find it more attractive to do business with private firms. The private sector share exhibits a significant, positive relationship with the FDI stock. Results with

	[1]	[2]	[3]	[4]
FDI_{t-1}	.673	.660	.714	.756
	(12.77)	(11.12)	(15.64)	(18.32)
FDI_{t-1}*direct	-.017	-.004	-.004	-.015
	(-0.71)	(-0.17)	(-0.14)	(-0.51)
FDI_{t-1}*nondirect	-.043	-0.38	-.037	-.041
	(-2.31)	(-2.12)	(-1.76)	(-1.88)
GDP_t	.405	.418	.429	.272
	(4.98)	(5.13)	(6.20)	(4.19)
$Integration_t$	.038	.041	.034	**-.028**
	(3.96)	(3.71)	(4.18)	**(-0.54)**
Relative unit	-1.306	-1.228	**-.107**	-.579
$labour\ cost_t$	(-2.71)	(-2.60)	**(-2.21)**	(-1.64)
$Risk_t$	**.257**	**.148**	.222	.222
	(2.07)	**(2.67)**	(1.94)	(2.15)
Privatisation				
$direct_t$	.204	.181	.179	.139
	(2.00)	(1.74)	(1.85)	(1.53)
$nondirect_t$	.010	-.006	-.006	.033
	(0.13)	(-0.07)	(-0.08)	(0.46)
Cumulative	.045	.041	.014	.026
$direct\text{-}nondir_{t-1}$	(2.59)	(2.33)	(1.02)	(1.49)
N	579	579	533	579
M1	-3.80	-3.71	-3.94	-4.01
M2	-1.07	-1.08	-1.11	-1.25
	(0.29)	(0.28)	(0.27)	(0.21)
Hansen χ^2	89.52	87.90	91.94	92.88
	(0.97)	(0.98)	(0.99)	(0.95)

[1] uses political risk instead of total risk; [2] uses the private sector share in GDP instead of risk; [3] uses skill-corrected wages instead of relative unit labour costs; and [4] includes the GDP of the source country instead of bilateral trade as a percentage of host country GDP

Table 3.7: Additional checks by replacing core variables with suitable proxies

respect to the other variables are unaffected with the exception of the measure for direct privatization, which is now only borderline significant at the 10%-level. This is not surprising in the sense that current privatization implies an immediate increase in the private sector share. Estimation [3] replaces the relative unit labour costs with a skill corrected wage measure. The latter is constructed as wages in euro divided by a skill measure, in turn defined as $\frac{EDU^3+EDU^2}{EDU^3+EDU^2+EDU^1}$ where EDU^x is gross education enrolment with $x = 3$ denoting tertiary education, 2 secondary education, and 1 primary education. The proxy is significant and has the expected negative sign. The effect of non-direct privatization on the intensity of the speed of adjustment is still significant, but only at the 10%-level. Privatization history loses significance. Finally, in [4] the integration variable is replaced by the real GDP of the source country in euro. Source country GDP itself is insignificant in explaining FDI stock. The privatization variables lose significance at conventional levels, except for the effect on the effect on the speed of adjustment that remains significant at the 10%-level. Relative unit labour costs are also no longer

significant.

Overall, our findings suggest that the traditional variables are fairly stable as determinants of FDI stocks in transition economies. A general measure for progress in reform is also robust to variations in the other explanatory variables. The same holds for the impact of non-direct privatization on the speed of adjustment of FDI to its equilibrium level. There are good indications that direct privatization strategies and privatization history contribute to higher FDI stocks, although the evidence is not as convincing as for the impact on the speed of adjustment.

3.6 Conclusions

Given the state of institutional and economic development, there is an equilibrium level of foreign involvement in an economy. The collapse of the central planning system initiated a flow of foreign investment to the CEECs. We think of FDI flows as an adjustment process towards the equilibrium level of the FDI stock. The observed FDI stock then reflects the impact of two driving forces. First, there is a 'positive feedback' effect that drives the stock towards its equilibrium level, even without changes in other determinants. Second, during the course of transition the determinants of the equilibrium level of FDI have changed. As a result the equilibrium level itself has shifted over time. A partial stock adjustment model nicely encompasses these features and gives rise to a dynamic panel estimation.

We find that adjustment towards equilibrium is rapid. As equilibrium is quickly reached a focus on the determinants of the equilibrium FDI stock is warranted. We investigate the factors that hamper or encourage FDI for a dataset of bilateral FDI stocks of old EU-members in ten CEECs. We combine a group of traditional factors with a group of institutional factors induced by the transition process. With respect to the traditional determinants, market potential and trade integration with the source country are positively related to the equilibrium FDI stock. Higher relative unit labour costs vis-a-vis the source country are associated with a lower equilibrium level of foreign presence. Lower perceived riskiness is associated with more FDI. In the case of transition countries perceived riskiness to a large extent reflects progress in institutional

development. We find that progress in almost all reform areas, as measured by the EBRD liberalization indicators, is associated with a better FDI record. Non-banking reform is the only exception. The relationship between FDI and privatization is investigated more thoroughly. Our results suggests that current direct privatization has an immediate concurrent positive effect on the equilibrium level of FDI, whereas non-direct privatization schemes slow down adjustment to the equilibrium. Finally, privatization history positively affects the equilibrium level independently of the method applied.

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Chapter 4

Conditional Spillovers from FDI within and between Sectors: Evidence from Romania

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Many countries have tailored their policies to attract as much foreign investment as possible hoping to gain access to technologies and skills not yet available to them. The strong belief in the advantages of foreign investment is however in stark contrast with the sobering empirical evidence. This paper argues that previous research on spillovers from foreign to domestic firms *i*) has been looking for them in the wrong place; *ii*) has to a large extent neglected conditionalities; and *iii*) has failed to take into account non-linearities. We extend the analysis to spillover effects across industries and we consistently find that intersectoral spillovers are much larger than sectoral spillovers. Our results also show that non-linearities need to be taken into account and that the direction and magnitude of spillovers depend on absorptive capability, export orientation, import competition and sectoral competition. The debate on the direction and magnitude of spillovers from foreign firms to local firms has only one good answer: it all depends and it depends in a way that makes economic sense.

4.1 Introduction

Foreign direct investment (FDI) provides a crucial source of investment finance to many a developing country. During the 1990s FDI even became the largest source of financing for developing economies (Aitken and Harrison, 1999). The most important role attributed to FDI is however not investment finance but technology transfer. Technology should be understood in the broad sense, not only including new production technologies and products, but also organizational and managerial practices and other tacit and codified know-how.[1] Multinational companies (MNCs) bring with them some amount of proprietary technology that constitutes their firm-specific advantage and allows them to compete successfully with indigenous firms that have the superior knowledge of local markets, consumer preferences, and business practices (Markusen, 1995). It is often hoped and believed that technology transfer will go beyond host firms and spill over to domestic firms as well. Many emerging market economies have tailored their policies to attract as much as possible foreign investment hoping to gain access to technologies and skills that are not yet available to them.

Strong beliefs in the positive effects of FDI are however in stark contrast with the sobering empirical evidence (Rodrik, 1999). The effects of FDI are manifold and have proven to be difficult to disentangle empirically. From their meta-study Görg and Strobl (2001) conclude that the different results in the empirical literature with respect to the existence and the direction of spillovers to domestic firms in the same sector are due to using industry-level data versus firm-level data, to cross-section versus panel data analysis, and to different measures of foreign presence (thus spillovers) at the industry level. The evolution of econometric techniques and the availability of firm-level panel data allowed to overcome some of the problems of the earlier literature but the evidence is still ambiguous. Recently, two possible explanations for the mixed evidence have gained attention. First, the idea that "it has always been there, you just have to discover it" has made way for the theoretical understanding that positive spillovers from foreign investment are not necessarily to be ex-

[1] There are off course other vehicles of technology transfer such as foreign trade and licensing. Licensing is likely to be less effective because the technology as a final product is detached from its developers. Trade may work as a channel of technology transfer either through importing intermediate products and capital equipment or through learning-by-exporting into industrial countries (Damijan *et al.*, 2003). However, the most effective method of technology transfer seems to be FDI.

pected. The failure to detect unambiguously positive effects may therefore not be due to the lack of the proper data or techniques but may instead simply reflect reality. This calls for more theoretical and empirical work to disentangle the various partial effects of foreign investment on local firm productivity to improve our understanding. Therefore the focus of attention is shifting to the identification of those region-, industry- and firm-characteristics that determine the occurrence and direction of spillover effects. Second, researchers may simply have been looking in the wrong place to detect spillovers. Indeed, rather than being confined to intrasectoral phenomena, the significant technology spillovers may run across sectors and stem from intersectoral linkages between foreign and domestic firms. The rediscovery[2] of these intersectoral effects has resulted in a number of studies identifying positive backward spillovers.

This paper on FDI spillovers in Romania contributes to the literature in several ways. *i*) Methodologically we contribute to the literature by using the Levinsohn and Petrin (2003) methodology. This semi-parametric technique corrects for endogeneity of input selection and allows us to obtain consistent estimates of capital and labour intensities. From the estimation, a measure of total factor productivity, the difference between actual and predicted output, is recovered. A fixed effect estimator is then applied to relate total factor productivity to different measures of foreign presence and some other control variables. This allows us to control for time invariant determinants of productivity across firms that are also potentially correlated with foreign presence variables. Further, it addresses the investor selection bias that arises because foreign investment typically goes to the more productive sectors. *ii*) Many studies analyse which region-, industry-, and firm-specific characteristics FDI spillovers depend on (see section 4.4), but most studies fail to take the interaction effects between these characteristics into account. We will devote explicit attention to possible interactions. *iii*) In the large majority of studies spillover effects are restricted to be linear. We will allow non-linear effects. *iv*) Most studies assume that spillovers only occur within the same sector. The few studies that analyse spillovers across sectors use input-output tables of only one year, while firms are observed over many year in a panel framework. This will bias the results, certainly in countries where the industrial structure

[2]See McAleese and McDonald (1978) and Lall (1980) for early analyses of intersectoral effects. Since then, theoretical work on linkage effects has been undertaken, but empirical research, until recently, has been scarce.

is subject to fast and abrupt changes. We will analyse spillovers both within and between sectors and will use a series of input and output tables to take into account changes in economic structure. *v*) The data on foreign ownership are usually only available for one year, while in reality they may change quickly. We use dynamic ownership data, which allows to identify the change in ownership over time. In short, in our dataset both ownership and economic structure are time-varying.

Below we review the various spillover effects analysed in the literature (section 4.2) and the empirical evidence found in the literature (section 4.3). Section 4.4 discusses possible characteristics FDI spillovers may depend on. Section 4.5 lays out the data sources and the estimation strategy. Results are presented in section 4.6 and we conclude in section 4.7.

4.2 Spillovers of foreign investment to local firm productivity

4.2.1 Direct and indirect effects

First, foreign firms are expected to be more productive than domestic firms because they would not enter the local economy otherwise. This is referred to as the 'direct' effect of FDI. MNCs possess intangible productive assets such as managerial skills, reputation, and technological know-how. Therefore they are able to compete successfully with local firms who have superior knowledge of local markets, consumer preferences and business practices (Blomström and Sjöholm, 1999). It is hard for MNCs to license their intangible productive assets to a host country firm because they are not easily codifiable in the form of patents and blueprints and difficult to value. They can however be transferred at reasonable cost to subsidiaries in the host country, i.e. foreign investment (Teece, 1977). This implies that foreign ownership is expected to raise the productivity of the firm that receives the investment.

Local firms may also be affected by foreign presence through indirect of 'spillover' effects. Clearly, if foreign affiliates are located in foreign enclaves and operate in isolation from local firms, there will be no or limited spillovers. If there is interaction between foreign-owned and local firms, there are a number of channels through which FDI affects the performance of host country firms.

Transmission mechanism	*Effect*	
Intrasectoral		
Demonstration effects	• Imitation of MNC technology and processes	+
	• Difficulties in absorption due to lack of technological capability	-
Labour market effects	• Hiring of MNC-trained staff with improved human capital	+
	• 'Poaching' of better staff by MNC; skill mismatch when hiring MNC-trained staff; upward pressure on wage costs	-
Competition effects	• Increased competition by MNC entry forces local firms to become more efficient and reduce costs	+
	• Domestic firms are pushed up their average cost curve because loss of market share to MNC	-
Intersectoral		
Backward linkages	• Explicit assistance by upstream MNC (new management practices (HRM; JIT); technology transfer) to upgrade quality/lower cost of products; quality standard requirments	+
	• Difficulties in integrating new technology within existing practices	-
Forward linkages	• Purchase of improved intermediate products, technological upgrading of own products	+
	• Incapable of using more advanced/complex inputs; rising costs of domestic suppliers (due to MNC competition) are passed on	-

Table 4.1: Overview of spillovers

Two major channels of spillovers have been identified: horizontal spillovers to local competitors and vertical spillovers to local suppliers and customers linked to the foreign firm in the production chain. Table 4.1 summarizes the different mechanisms and their possible impact put forward in the literature. Figure 4.1 illustrates how these spillovers run through the host economy's production chain.

4.2.2 Horizontal spillovers

FDI could generate a beneficial transfer of know-how and technology from MNCs to local firms in the same sector. Teece (1977) describes various channels through which this technology diffusion effect may run. The two main channels are labour turnover from foreign firms' trained workers to local firms (see also Fosfuri *et al.*, 2001) and imitation of nearby technology (the demonstration effect). Further, foreign firms may bring along professional services as accounting and consulting firms whose services become available to domestic firms as well. On the other hand, informed MNCs will obviously attempt to

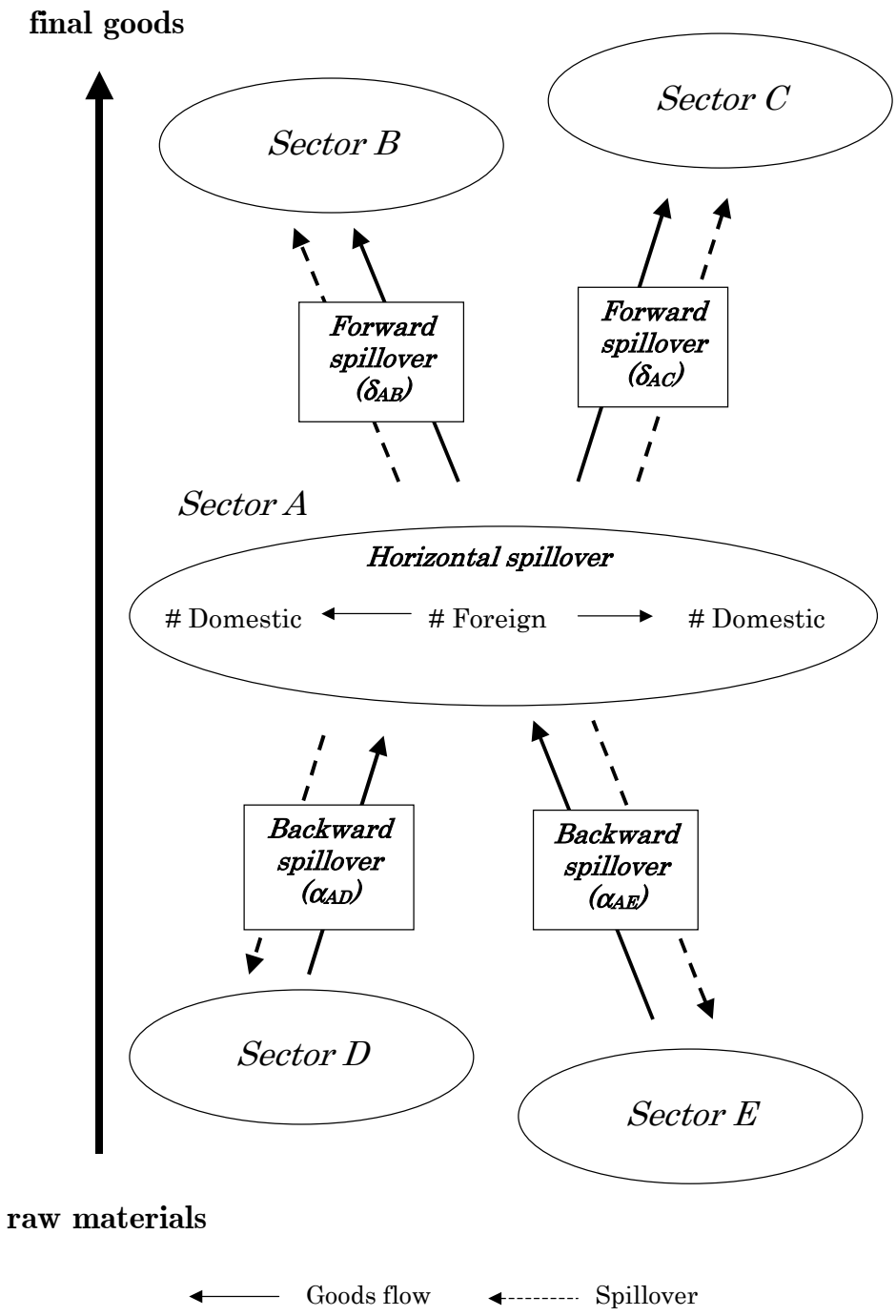

Figure 4.1: Spillovers through the host economy's production chain

minimize technology leakage to local competitors, and may even refrain from entering if they fear that their technology will be easily open to copying. MNCs may not bring their state-of-the-art technology with them but technology only slightly ahead of the host country technology frontier in order to minimize leakage (see Glass and Saggi, 1998). The scope for horizontal spillovers may therefore be rather limited. Labour market dynamics may also entail some negative spillovers, such as the brain drain of local talent to foreign-owned firms to the detriment of local firm productivity (Blalock and Gertler, 2003) and an increase in wages for all firms that does not reflect improvements in productivity as MNCs often pay higher wages (Aitken *et al.*, 1996).

The entry of MNC affiliates also disturbs the existing market equilibrium and stimulates competition. This increased competition provides another important channel of spillover effects to local firms (see among others Aitken and Harrison, 1999, and Glass and Saggi, 2002). Fiercer competition urges host country firms to use existing technologies and resources more efficient, or to adopt new technologies and organizational practices. Considering the typical characteristics of a multinational entrant (scale economies, more advanced technology, high initial capital), they are able to enter even sectors with high entry barriers and can raise competition where domestic entry cannot (Blomström and Kokko, 1998). The latter type of sectors are typically characterized by high concentration and inefficiency due to the limited competition. Foreign entry then will force existing domestic firms with some monopoly power to become more efficient. On the other hand, if MNC entry attracts away demand from domestic competitors, this pushes the latter up their average cost curves and may ultimately even drive them out of the market if they cannot live up to the increased competition (the market-stealing effect, see Aitken and Harrison, 1999). Empirically, it is very hard to disentangle these partial effects and therefore the net effect of horizontal spillovers remains uncertain.

4.2.3 Vertical spillovers

Spillovers are not limited to intrasectoral phenomena. In fact the most important spillovers may run across sectors. Foreign firms not only compete with local firms in the same sector, but also interact with local firms that are upstream or downstream in the production chain. Figure 4.1 illustrates how to identify backward spillovers (between a foreign firm and its upstream local sup-

pliers) and forward spillovers (between a foreign firm and its downstream local buyer of inputs). Though MNCs may seek to minimize technology leakage to direct competitors (the horizontal effect), they have an incentive to assist their local suppliers to deliver high quality inputs, because they can only realize the full benefits of their investment if the quality of inputs in the host country is close enough to the quality in the home country, but at lower cost (Blalock and Gertler, 2003). This incentive should be qualified in at least two cases. First, provided that the transportation costs between home and host country are not too high, MNCs may source inputs in their home country, rather than in the host country. Second, MNCs may cut ties with local suppliers and induce suppliers from their home country to invest in the host country as well, creating an isolated enclave of mutually linked firms.

If an MNC decides to source locally and assist its suppliers, it will transfer technology to more than one domestic supplier or encourage technology diffusion upstream in order to circumvent a hold-up problem. The foreign firm provides a stable demand for inputs to the host country supplier, enabling it to build a stock of experienced employees and appropriate physical capital. It is therefore expected that the backward linkage spillovers will boost local firm productivity and competitiveness. However, domestic firms that cannot live up to the standards required by the downstream MNC may get hurt by increased competition of its local rivals that do supply the MNC. Rodriguez-Clare (1996) shows that the backward linkage effect of multinationals on the host country is more likely to be favourable if the good that MNCs produce uses intermediate goods more intensively and if home and host countries are not too different in terms of the variety of intermediate goods produced. If these conditions are reversed, then MNC investment could even hurt the host economy. Hence, if intermediate inputs in the host country are still too different from intermediate inputs in the home country (e.g. too low quality), a negative backward linkage spillover may result.

Figure 4.1 also exhibits an equivalent forward linkage effect, where better inputs due to foreign investments affect the productivity of all firms that use these inputs, also local firms. On the other hand, the inputs produced locally by MNCs may be more expensive and not adapted to local requirements. Therefore foreign investment in input sectors may mainly be beneficial to already more productive foreign enterprises that are more fit to handle the

better but more expensive inputs. This will lead to an increased productivity difference between local and foreign enterprises in the sector that uses the input, a negative forward linkage spillover follows.

Markusen and Venables (1999) study the trade-off between increased product market competition (the intrasectoral competition effect), which in their model is always negative for local firms, and intersectoral linkage effects that may have a positive effect on local firms. They show how FDI can act as a catalyst for economic development if the linkage effects are sufficiently strong: foreign investors may stimulate demand for locally produced intermediate products. This demand stimulus for higher quality inputs may encourage local suppliers to invest and produce inputs conform to higher quality standards (see also Blomström and Kokko, 1998). This has not only a positive effect on the productivity and the export potential of the local intermediate producers. It can also stimulate the emergence of more efficient local producers in the consumer product industry and may ultimately drive the MNCs out of the local market.

As with the horizontal spillovers above, one can only conclude that it all depends, and therefore that the net effect of vertical spillovers is uncertain.

4.3 Empirical evidence - Lack of consensus

The list of possible spillover effects in table 4.1 is long and inconclusive about the sign and the magnitude of FDI spillovers. Which effects matter, in which direction and to what extent, is ultimately an empirical question. The empirical literature can be classified in three types of studies: i) case studies, ii) cross-section studies (both at industry and firm-level studies), and iii) panel studies (mostly firm-level).

Case studies (e.g. Teece, 1977, or Lall, 1980) are very informative and provide detailed information but they cannot easily be generalized. The studies that pool data on the industry- or firm-level fall into two categories: cross-section studies and panel data studies. Caves (1974) and Globerman (1979) are among the first to test spillover effects statistically. They find positive horizontal spillovers for a cross-section of industries in Australia and Canada respectively. Blomström (1986) also finds positive spillovers for a cross-section of industries in Mexico. This is a feature that can also be inferred from table

4.2: cross-section studies typically find a positive correlation between FDI and local firm productivity. Cross-sectional studies, however, cannot differentiate a positive FDI-effect from a simple investor selection bias. The latter would arise if foreign investment would typically go to the more productive sectors. For example, Harris and Robinson (2002) show that foreign-owned enterprises tend to acquire the most-productive plants for a panel of UK manufacturing firms.

Improved detailed data collection has provided research units with large firm-level datasets. New econometric techniques have made firm level panel data studies the standard framework to investigate the empirical validity of FDI spillover effects. Panel data techniques allow to control for investor selection bias and other unobserved firm-specific effects. Firm level studies typically make use of an extended production function. Empirical testing of spillovers is then done by adding an indicator of foreign ownership to a production function. This approach does not, however, shed light on "how" the spillovers take place. The evidence arising from panel data studies -after controlling for selection bias- is still mixed.

For example, Aitken and Harrison (1999) find negative horizontal spillovers for a panel of Venezuelan firms, while Haskel *et al.* (2002) find positive horizontal spillovers for the UK. Aitken and Harrison (1999) attribute their result then to the fact that domestic firms cannot withstand the increased competition. Konings (2001) finds negative horizontal spillovers in a panel of Romanian firms, but there is no evidence of spillovers in Bulgaria and Poland. Djankov and Hoekman (2000) find negative spillovers from joint ventures and FDI together in the Czech Republic (1992-96). With FDI alone however, the spillover loses magnitude and significance. For a panel of Estonian firms Sinani and Meyer (2004) confirm the existence of positive spillovers after introducing technology and competition control variables. Yudaeva *et al.* (2003) find strong positive spillovers for medium-sized Russian firms, but negative spillovers for small firms. Damijan *et al.* (2003) find positive spillovers for five out of ten EU-accession states they analyse.

Whereas most studies focused on intrasectoral or horizontal effects, recently an empirical literature focusing on vertical or intersectoral effects has developed. Firm level panel datasets are then combined with input-output tables. The latter are used to create linkage coefficients between sectors. The

Paper	Data	Aggreg.	Country	D[a]	H[a]	F[a]	B[a]
Developing countries							
Blomström (1986)	cs	industry	Mexico		+	na	na
Haddad and Harrison (1993)	panel	micro	Morocco		?	na	na
Kokko (1994)	cs	industry	Mexico		+	na	na
Kokko (1996)	cs	industry	Mexico		+	na	na
Aitken and Harrison,(1999)	panel	micro	Venezuela		-	na	na
Blomström and Sjöholm (1999)	cs	micro	Indonesia		+	na	na
Sjöholm (1999)	cs	micro	Indonesia		+	na	na
Kathuria (2000)	panel	micro	India		?	na	na
Kugler (2001)	panel	industry	Colombia		?	na	na
Blalock and Gertler (2004)	panel	micro	Indonesia		?	na	+
Transition countries							
Djankov and Hoekman (2000)	panel	micro	Czech Republic	+	-	na	na
Kinoshita (2001)	panel	micro	Czech Republic	?	?	na	na
Konings (2001)	panel	micro	Bulgaria	?	-	na	na
			Poland	+	?	na	na
			Romania	?	-	na	na
Zukowska-Gagelmann (2000)	panel	micro	Poland	?	-	na	na
Damijan *et al.* (2003)	panel	micro	10 EU-candidates	+ (3) - (4)	+ (5) - (0)	+ (2) - (4)	+ (4) - (2)
Yudaeva *et al.* (2003)	panel	micro	Russia	+	+	-	-
Smarzynska Javorcik and Spatareanu (2003) [b]	panel	micro	Romania	na	-/+	na	+/-
Smarzynska Javorcik (2004)	panel	micro	Lithuania	?	?	-/?	+
Sinani and Meyer (2004)	panel	micro	Estonia	na	+	na	na

Notes:
results refer to the main or preferred estimation: + positive and signidicant result; - negative and signidicant result; ? insignificant result
[a] D: direct effect; H: horizontal spillover; F: forward spillover; B: backward spillover
[b] distinction: minority/majority owned foreign firms
For developed countries see Görg and Greenaway (2003)

Table 4.2: Non-exhaustive overview of papers on spillovers in developing and transition economies

enriched datasets then allow to test for vertical spillovers. Damijan *et al.* (2003) find both positive and negative vertical spillovers for the ten transition countries they examine. In most countries vertical spillovers are found to be more important than horizontal spillovers. Schoors and Vandertol (2002) find for Hungary that intersectoral spillovers are economically much more important than sectoral spillovers. Smarzynska Javorcik (2004) analyses Lithuanian firm-level data. Her results are consistent with the existence of productivity spillovers from FDI taking place through contacts between foreign firms and their domestic suppliers in upstream sectors.

A lot of studies only consider domestic firms for the econometric analysis and thus do not test for a direct effect of foreign investment. Nevertheless, the studies that do test for the direct effect do not find unequivocally positive effects. Djankov and Hoekman (2000) find a significant positive impact of FDI on total factor productivity growth of recipient firms in the Czech Republic, while Kinoshita (2001) does not, though her sample is much smaller. Konings (2001) analyses three other transition countries. He finds that foreign firms

do not perform better in Bulgaria and Romania, but do so in Poland. He suggests that it may take time for ownership effects to have effect on firm performance. Yudaeva *et al.* (2003) find that foreign owned firms in Russia are more productive than domestic ones, but that poor progress of reform in the region of location negatively affects productivity of foreign owned firms. Damijan *et al.* (2003) find a significant positive direct effect of FDI only in three out of the ten transition countries they examine, in four countries the effect is negative.

4.4 Conditional spillovers

Recently the literature has come to the understanding that the existence, direction and magnitude of spillovers may depend on sectoral, regional and firm-specific characteristics. If this is true, aggregate studies are bound to find insignificant or biased results. This leads us to focus on characteristics that make domestic firms sensitive to spillovers. This can be achieved by interacting a measure of foreign presence with the variable reflecting the characteristic or by splitting the sample depending on the level of the characteristic under scrutiny. Absorptive capability, openness, sectoral competition and concentration, ownership type (especially in transition economies), majority versus minority foreign ownership, and firm size have all been suggested as characteristics that affect FDI spillovers.

4.4.1 Absorptive capability

Findlay (1978) constructs a dynamic model of technology transfer through FDI from developed to developing countries. He argues a positive connection between the distance to the world's technological frontier and the rate of growth. The result form Findlay's model is that, for a given amount of foreign presence, spillovers are larger the larger the technology gap between foreign and domestic firms. The further you are behind, the more there is to gain. However, the technology gap is also an expression of the absorptive capability of domestic firms. This changes the interpretation completely. It implies that the bigger the gap, the harder it will be to absorb the technology and managerial practices of foreign firms.

Many empirical studies lend support to the last hypothesis. Blomström (1986) finds that foreign entry is related to structural changes in that part of the sector that uses 'modern' technology. This is a first reference to the importance of the technology gap in the sense of absorptive capability. When the initial difference in technology between the foreign firm and the domestic firm is large and human capital is poor, the foreign firm is likely to suffocate local unproductive competitors (the market-stealing effect). However, if the technology gap is not small and human capital is well developed, the increased competition may stimulate a productivity catch-up by local firms. The direction of the horizontal competition effect therefore depends on the absorptive capacity of the local firm, as measured by its level of technology and quality of human capital. Sjöholm (1999) finds for Indonesian firms that high technology differences give rise to large spillovers, although results are sensitive to the choice of technology gap measure. Kokko *et al.* (1996) analyse horizontal spillovers in a cross-section of Uruguayan plant-level data. They use two subsamples based on the technology gap between foreign and domestic firms. Horizontal spillovers are positive and significant only in the sub-sample of plants with small or moderate technology gaps *vis-a-vis* foreign firms. Small or moderate technology gaps seem to identify cases where foreign technologies are useful for the local firms, because the local firms possess the skills needed to apply or learn the foreign technologies. Large gaps, on the other hand, may signal that foreign technology is not relevant (because different product varieties or qualities are produced), or that local technological capability is so weak that foreign technologies can neither be used nor learned by the local firms. Firm level R&D is also related to absorptive capability. Cohen and Levinthal (1989) point out that R&D not only stimulates innovation but also increases a firm's absorptive capability, i.e. its ability to identify, assimilate, and exploit outside knowledge. Kinoshita (2001) and Sinani and Meyer (2004) also mention that the effects of foreign investment may depend on R&D investment by the local firm.

The results in the empirical literature lend support to the absorptive capability hypothesis, but fail to take into account possible non-linearities. Obviously, if a firm is too far behind, it will not be able to absorb because it lacks the skills to do so and negative spillovers will follow. If a firm is too close to the foreign technology frontier however, spillovers are also likely to be

small because there is not a lot to gain through spillovers. Moreover, Aitken *et al.* (1996), Fosfuri *et al.* (2001), and Glass and Saggi (2002) claim that foreign firms pay higher wages to stimulate the movement of skilled labour from domestic to foreign firms. These highly qualified employees are likely to be drained from the domestic firms closest to the foreign technology frontier. This suggests that absorptive capability may affect spillovers in a non-linear way, with the positive effects of spillovers mainly accruing to host country firms not too far behind and not too close to the efficiency frontier. Measuring absorptive capability is also quite problematic. The literature has employed the following measures of technology gap: *i*) different industries' capital intensities; *ii*) amount of patent fees in different industries or equivalent measures of R&D intensity; *iii*) difference in labour productivity in foreign and domestic firms; *iv*) the level of intangible fixed assets; *v*) firm specific distance to an estimated efficient frontier. Each version comes with its problems. We use a new and unbiased definition of absorptive capability (*cf. infra*).

4.4.2 Openness

Export-oriented firms produce for foreign markets so that they already have contact with foreign firms, new technology and higher competition. This provides them with additional channels to learn and absorb spillovers. On the one hand, this reduces the scope for spillovers, but on the other hand export-oriented firms are probably better 'equipped' to absorb new technology. Their absorptive capability will be higher on average and therefore a market-stealing effect is not likely. It is to be expected therefore that sectoral spillover effects are less important in very open sectors, because both the negative and the positive effects of sectoral spillover are less likely to occur. Schoors and Vandertol (2002) find that spillover effects vary strongly with openness. Sinani and Meyer (2004) also find that trade orientation matters for spillovers. As regards import competition, Sjöholm (1999) finds for Indonesian firms that domestic competition rather than openness to import competition affects FDI spillovers.

4.4.3 Sectoral competition

Predictions from the theoretical literature concerning the effect of competition on productivity are not univocal. Wang and Blomström (1992) stress the importance of competition for FDI spillovers. High competition forces the foreign subsidiaries to bring in relatively new and sophisticated technologies from the parent company in order to retain their market shares. The conclusion is that the tougher the competition, the more technology will be brought in by the MNC affiliate and the larger the potential for spillovers will be. The reverse reasoning also applies and reinforces the argument. Kokko (1994, 1996) examined the effect of FDI on productivity in different manufacturing sectors. A high technology gap in combination with a low degree of competition was found to prevent spillovers. There is however a serious identification problem in examining productivity levels, as foreign firms may locate in highly productive sectors. Nickell (1996) finds evidence of a generally positive impact of competition on productivity growth in his empirical analysis. Sjöholm (1999) finds in an Indonesian dataset that high sectoral competition (measured by a Herfindahl index) raises the magnitude of FDI spillovers, suggesting that the degree of competition affects the choice of technology transferred to the multinational's affiliate, and hence the potential for spillovers.

4.4.4 Firm size

If larger firms have more resources to exploit innovative opportunities, they should be able to benefit more from foreign technology. On the other hand small and medium sized firms are often important sources of innovation. Small firms make important contributions to innovation because they are less bureaucratic and they exploit innovations that are too small to interest large firms (Sinani and Meyer, 2004). This could be specifically true in Romania, where most large enterprises are former state enterprises that are often not well equipped to quickly adopt new technologies or adapt their structure.

4.4.5 Level of foreign ownership

Blomström and Sjöholm (1999) suggest that the spillovers through technology diffusion and learning may be larger with larger local participation in the foreign firms, because this facilitates access to the technology. However, foreign

firms with a larger local participation have less control over profits and their proprietary knowledge. This may restrain them to bring in state-of-the-art technology, thereby reducing the scope for spillovers. In their cross-section analysis of Indian firms, Blomström and Sjöholm (1999) find that establishments with minority and majority foreign ownership indeed differ in the degree of FDI spillovers. Smarzynska Javorcik and Spatareanu (2003) perform the same test in a panel of Romanian firms. They find that positive horizontal spillovers originate from majority owned foreign firms, because they bring more advanced technology with them, while minority-owned foreign firms are associated with negative horizontal spillovers. With respect to backward spillovers, the direction of the effect switches. Minority-owned foreign firms give rise to positive backward linkages, while majority-owned foreign firms give rise to negative spillovers. This is most likely due to the firms with local participation sourcing their inputs locally. These findings are confirmed for Lithuania in Smarzynska Javorcik (2004). Partial ownership generates positive backward spillovers, full ownership no backward spillovers.

4.5 Empirical approach, data, and variables

4.5.1 Empirical approach

In line with earlier literature we will start from a standard production function and then introduce variables reflecting foreign presence. When estimating production functions, the problem arises that firms react to firm-specific productivity shocks that are not observed by the researcher. Firms that have a large positive productivity shock may respond by using more inputs. Here, one has to make the distinction between freely variable inputs, in particular labour and materials, that react concurrently to productivity shocks, and state variables such as capital that react with a lag. Griliches and Mairesse (1995) provide a detailed account of the problem and make the case that inputs should be treated as endogenous variables since they are chosen by a firm based on its productivity, which is observed by the producer but not by the econometrician. To the extent that this is true OLS estimates of production functions will yield biased estimates of factor shares, and, by implication, biased estimates

of productivity.[3]

Some studies attempt to correct for the simultaneity bias by assuming that the unobserved firm heterogeneity can be captured by a time-invariant fixed effect or by using instrumental variables. However, both approaches rely on the simplifying assumptions of time-invariance of the firm-specific effect in the former case and no serial correlation of the productivity shocks in the latter and are, therefore, not entirely satisfactory. Therefore we employ in a first step the semi-parametric approach suggested by Olley and Pakes (1996) and modified by Levinsohn and Petrin (2003). This method allows for firm-specific productivity differences that exhibit idiosyncratic changes over time. To illustrate the insights of the method we start with the following production function that will be estimated sector by sector. Estimation therefore will deliver sector-specific labour and capital intensities.

$$\forall j : \ln VA_{irt} = \beta_0 + \beta_l \ln L_{irt} + \beta_k \ln K_{irt} + \omega_t + \eta_t \tag{4.1}$$

where subscripts irt stand for firm i and region r at time t, and j stands for sector j. VA stands for real value added of the firm, L is the freely variable input labour and K is the state variable capital. The error has two components, the transmitted productivity component given as ω, and η, an error term that is uncorrelated with input choices. The key difference between ω and η is that the former is a state variable and hence impacts the firm's decision rules. ω is not observed by the econometrician, but the firm immediately adjusts it freely variable input L to it. We focus on value added rather than sales because it is a better measure of firm performance. Consider the following version where small cases refer to variables in logs and firm and region subscripts have been dropped.

$$va_t = \beta_0 + \beta_l l_t + \beta_k k_t + \omega_t + \eta_t \tag{4.2}$$

Levinsohn and Petrin (2003) start by assuming that the demand for the intermediate input, materials m_t, depends on the firm's state variables k_t and ω_t:

$$m_t = m_t (k_t, \omega_t) \tag{4.3}$$

Making mild assumptions about the firm's production technology, it can be

[3] In particular the coefficient of labour is biased upwards, while the capital coefficient is biased downwards.

shown that the demand function is monotonically increasing in ω_t. This allows inversion of the intermediate demand function, so ω_t can be written as a function of k_t and m_t.[4]

$$\omega_t = \omega_t (k_t, m_t) \tag{4.4}$$

The unobservable productivity term is now expressed solely as a function of two observed inputs. Following Olley and Pakes (1996), Levinsohn and Petrin (2003) make a final identification restriction by assuming that productivity is governed by a first-order Markov process:

$$\omega_t = E [\omega_t | \omega_{t-1}] + \xi_t \tag{4.5}$$

where ξ_t is an innovation to productivity that is uncorrelated with k_t (but not necessarily with l_t; this is part of the source of the simultaneity problem). The estimation routine itself starts with transforming (4.2).

$$\begin{aligned} va_t &= \beta_0 + \beta_l l_t + \beta_k k_t + \omega_t + \eta_t \\ &= \beta_l l_t + \phi_t (k_t, m_t) + \eta_t \end{aligned} \tag{4.6}$$

where

$$\phi_t (k_t, m_t) = \beta_0 + \beta_k k_t + \omega_t (k_t, m_t) \tag{4.7}$$

By substituting a third-order polynomial approximation in k_t and m_t for $\phi_t (k_t, m_t)$, it is possible to consistently estimate parameters as

$$va_t = \delta_0 + \beta_l l_t + \sum_{g=0}^{3} \sum_{h=0}^{3-h} \delta_{gh} k_t^g m_t^h + \eta_t \tag{4.8}$$

where β_0 is not separately identified from the intercept of $\phi_t (k_t, m_t)$. This completes the first stage of the estimation routine from Levinsohn and Petrin

[4] Due to possible correlation with labour and capital, direct FDI participation in the firm may distort the estimation. We focus, however, on domestic firms only. What about the spillovers defined in section 4.2.2 and 4.2.3? Since we estimate a production function for each sector separately and because the spillover variables are sector-specific, there is only variation in the time dimension. The correlation between labour and capital on the one hand and spillover variables on the other hand is fairly low (below 0.2 for almost all spillovers in all sectors). Furthermore, the possible correlation will to some extent be accounted for in the analysis. If ω_t is a function of foreign presence, this will be reflected in material input choice because $m_t = m_t (k_t, \omega_t (foreign))$. The inverted function then reads $\omega_t = \omega_t (k_t, m_t (foreign))$.

(2003), from which an estimate of β_l and an estimate of ϕ_t (up to the intercept) are available. The second stage of the estimation procedure begins by computing the estimated value for ϕ_t using

$$\widehat{\phi}_t = \widehat{va}_t - \widehat{\beta}_l l_t \tag{4.9}$$

$$= \widehat{\delta}_0 + \sum_{i=0}^{3} \sum_{j=0}^{3-i} \widehat{\delta_{ij}} k_t^i m_t^j \tag{4.10}$$

For any candidate values β_k^* , on can compute (up to a scalar constant) a prediction for ω_t for all periods t using

$$\widehat{\omega}_t = \widehat{\phi}_t - \beta_k^* k_t \tag{4.11}$$

Using the $\widehat{\omega}_t$'s for all t, a consistent (non-parametric) approximation to $E[\omega_t|\omega_{t-1}]$, say $E\left[\widehat{\omega_t|\omega_{t-1}}\right]$, is given by the predicted values from the regression

$$\widehat{\omega}_t = \gamma_0 + \gamma_1 \widehat{\omega}_{t-1} + \gamma_2 \widehat{\omega}_{t-1}^2 + \gamma_3 \widehat{\omega}_{t-1}^3 + \varepsilon_t \tag{4.12}$$

Given $\widehat{\beta}_l$, β_k^*, and $E\left[\widehat{\omega_t|\omega_{t-1}}\right]$ the sample residual of the production function can be written as

$$\widehat{\eta_t + \xi_t} = va_t - \widehat{\beta}_l l_t - \beta_k^* k_t - E\left[\widehat{\omega_t|\omega_{t-1}}\right] \tag{4.13}$$

The estimate $\widehat{\beta}_k$ of β_k can then be defined as the solution to[5]

$$\min_{\beta_k^*} \sum_t \left(va_t - \widehat{\beta}_l l_t - \beta_k^* k_t - E\left[\widehat{\omega_t|\omega_{t-1}}\right] \right)^2 \tag{4.14}$$

Since each of the two main stages of estimation involves a number of preliminary estimators, the covariance matrix of the final parameters must account for the sampling variation introduced by all of the estimators used in the two stages. Although deriving an analytic covariance matrix may be feasible, this calculation is not trivial. Instead Levinsohn and Petrin (2003) substitute computational power for analytic difficulties, employing the bootstrap to estimate standard errors.[6]

[5] A golden section search algorithm is used to minimise (4.14).

[6] Given the use of panel data, sampling occurs with replacement from firms, using the entire time series of observations for that firm in the bootstrapped sample when the firm's

From the estimation we recover a measure of total factor productivity, tfp as follows

$$\forall j : tfp_{irt} = va_{irt} - \widehat{\beta}_l l_{irt} - \widehat{\beta}_k k_{irt} \tag{4.15}$$

which is the difference between the actual value added and inputs multiplied by their respective coefficients. We use it in the estimation of (4.16) where we relate total factor productivity to the measures of foreign presence, a concentration index, and sector, region, and time dummies (α_j, α_r, and α_t). Note that we use all sectors in the estimation of (4.16), whereas (4.15) is based on a sector-specific estimation.[7]

$$tfp_{ijrt} = \alpha_i + \alpha_1 f(FDI) + \alpha_2 Conc_j + \alpha_j + \alpha_r + \alpha_t + \varepsilon_{ijrt} \tag{4.16}$$

Concentration -$Conc$ in (4.16)- is the sectoral Herfindahl concentration index. Nickell (1996) points out that the theoretical literature is inconclusive about the impact of competition on productivity. In his empirical analysis he finds a positive impact of competition on firm performance, if this is the case α_2 can be expected to be negative. $f(FDI)$ covers different transformations of the horizontal and vertical spillovers (see sections 4.2.2, 4.2.3, and 4.5.2 below), conditioned on the characteristics discussed in section 4.4. This involves several rounds of regressions.

A first set of regressions will, in line with earlier literature test for the level effect of horizontal and vertical spillovers. In a second set of regressions we introduce quadratic terms to allow non-linear spillover effects. Further sets of regressions will deal with firm and industry characteristics that are possibly decisive for the occurrence and direction of spillovers. Conditioning can be done either through interacting the spillover variables with the characteristics or by splitting the sample in subsamples based on cutoff values for the characteristics.[8] When combining characteristics, a sample-split will ease comparison and

ID-number is randomly drawn. A bootstrapped sample is complete when the number of firm-year observations (closely) equals the number of firm-year observations in the original sample. The variation in the point estimates across the bootstrapped samples provides an estimate for the standard errors of the original point estimates. (see Petrin *et al.*, 2004)

[7] Also note that (4.5) is an empirical approach used for identification within a sector, whereas (4.16) is a structural approach applied to the entire dataset.

[8] Obviously, the latter strategy is equivalent to transforming the characteristic under scrutiny into one or more dummy variables according to the categories one defines and

interpretation. The former strategy is appropriate when one expects a continuous relationship between the characteristic and the spillover effect, whereas the latter is more focused on 'breaks' in the relationship. We consider interaction effects with absorptive capability and in further rounds of regressions we test whether the found FDI spillovers depend on competition from imports, export orientation, and sectoral concentration by splitting up the sample in a novel way. Finally, we verify whether the found effects depend on firm size and the degree of foreign ownership respectively.

4.5.2 Data description and variable definitions

Romanian firm-level data for 1996-2001 are drawn from the Amadeus database provided by Bureau Van Dijk. Sectoral price level data for manufacturing at Nace[9] 2-digit level taken from WIIW Industrial database and from the Statistical Yearbook of the Romanian National Statistical Office. They are used to appropriately deflate the raw data (see below for details). Our sectoral classification follows the classification used in the Romanian input-output tables. Appendix A describes the sectors and links them to the Nace classification scheme. The whole series of Amadeus DVDs is used to reconstruct a database of time-specific foreign entry in local Romanian firms.[10] Since ownership information is gathered at irregular intervals rather than continuously monitored, we do not have ownership information for all years for all firms. Because of the irregular intervals ownership changes show up only *ex post* in the database. Therefore we choose to fill the gaps with the information from the following year for those firms whose ownership structure has not been investigated every year. Input-output tables for the period 1998-2001 are obtained from the Romanian National Statistical Office. Both the ownership data and the input-output tables are necessary for the construction of the FDI spillover measures (*cf. infra*). In addition the ownership data gives us the degree of foreign ownership, while the input output tables give us the information on the sectoral level of import competition and export orientation.

Value added is calculated as real output Y, measured as sales deflated by producer price indices of the appropriate Nace sector minus real material

interacting all explanatory variables with the dummies.

[9] *Nomenclature générale des activités économiques dans les Communautés européennes.*

[10] A DVD includes only the most recent ownership information.

input M, measured as material costs deflated by a weighted intermediate input deflator where the sector-specific weighting scheme is drawn from the input-output tables. Labour L is expressed as the number of employees. Real capital K is measured as fixed assets, deflated by the average of the deflators for the following five Nace-sectors: machinery and equipment (29); office machinery and computing (30); electrical machinery and apparatus (31); motor vehicles, trailers, and semi-trailers (34); and other transport equipment (35). This approach follows Smarzynska Javorcik (2004). Concentration, $Conc$, is the Herfindahl concentration index defined at the sectoral classification found in the appendix.[11] α_j, α_r, and α_t are 101 sector, 41 region, and 4 annual time dummies respectively.

$f(FDI)$ in (4.16) is a shorthand for all possible spillover effects from FDI, conditioned on the criteria discussed in section 4.4. The variables, $Horizontal$, $Forward$, and $Backward$ are proxies for the spillover effects of FDI on firm productivity as illustrated in figure 4.1. $Horizontal$ is a proxy for the foreign presence sector j at time t. It is defined as the share of foreign firms' output in total sector output.

$$Horizontal_{jt} = \frac{\sum_{i \in j} Foreign_{it} * Y_{it}}{\sum_{i \in j} Y_{it}} \tag{4.17}$$

$Horizontal$ can be varied with different interpretations of $Foreign$. The most crude measure is a dummy, say F_{ijrt}, that takes the value 1 if there exist foreign participation over 10% in a firm. Alternatively, the Amadeus database allows to use a variable that indicates the share of a firm's total equity owned by foreign investors, $FShare_{ijrt}$. It is difficult to state a preference for one or the other. Focusing on shares implicitly implies the assumption of a linear relation between the sophistication of technology brought in and the level of participation. The use of a dummy on the other hand completely ignores any possible relation. We have a small preference for the dummy over the percentage bearing in mind that the idea behind spillovers is that foreign firms are technologically more advanced than domestic firms. Nevertheless, we present evidence for both. A middle way classification is obtained by using several dummy variables that indicate whether the foreign involvement consti-

[11] The Herfindahl index is defined as the sum of the squared market shares of the firms in a sector.

tutes minority, majority or full ownership ($FFUL_{ijrt}$; $FMAJ_{ijrt}$; $FMIN_{ijrt}$). This gives rise to three separate horizontal measures and consequently three backward and forward measures (*cf. infra*). We will apply this classification as additional test. The higher the value of output of foreign firms and -depending on the interpretation of $Foreign$- the higher the share of foreign equity in foreign enterprises, the higher the value of $Horizontal$. Alternatively $Horizontal$ can be defined in terms of the share of foreign employment in total employment. We use both definitions in various specifications.

$Backward$ and $Forward$ are the basic measures for vertical spillovers. $Backward$ is used to test whether MNCs that source inputs locally transfer technology to their suppliers. In principle we want to know the share of a firm's output that is sold to foreign-owned firms. Information this detailed is not available in our dataset, however. Moreover, the share sold to foreign firms is likely to be endogenous if the latter prefer to buy their inputs from the more productive domestic firms. We proxy the share of a firm's output sold to foreign firms with the share of the sector's output sold to foreign firms in different downstream markets. This makes endogeneity unlikely as MNCs cannot easily switch between sectors for their inputs. The input-output tables tell us the amount that sector j supplies to its sourcing sectors k. We also know the share of output in all sectors k that is produced by foreign owned firms, i.e. $Horizontal_{kt}$. If we assume that a firm's share in sectoral use of a particular input is proportional to its share in total sector output, then we can measure the share of a sector's output sold to foreign firms as:

$$Backward_{jt} = \sum_{k \ if \ k \neq j} \alpha_{jkt} Horizontal_{kt} \tag{4.18}$$

where α_{jkt} is the proportion of sector j's output supplied to sourcing sector k. The αs are calculated from the input-output tables. We explicitly exclude inputs sold within the firm's sector ($k \neq j$) because this is captured by $Horizontal$.[12]

[12] Consider the following example to clarify the definition a bit more: consider three sectors j, k_1, and k_2. Suppose that half of the output of j is purchased by k_1 and the other half by k_2. Further suppose that no foreign firms are active in k_1, but half of the output of k_2 is produced by foreign firms. The backward variable for sector j then becomes: $(0.5 * 0.0) + (0.5 * 0.5) = 0.25$. It is now easily seen that the value of $Backward$ increases with foreign presence in the sectors k that source inputs from j and with the share of output of sector j supplied to industries with MNC presence.

	full sample			domestic sample		
	N	mean	st. dev.	N	mean	st. dev.
real output	244261	9.088	2.043	215702	8.898	1.944
real materials	245680	8.231	2.310	216923	8.081	2.239
real capital	243118	7.199	2.490	214358	6.945	2.373
labour	227937	1.771	1.451	200659	1.627	1.325
absorptive capability	227937	0.161	0.186	200659	0.149	0.173
Herfindahl	244261	0.025	0.046	215702	0.024	0.043
output based						
horizontal	244261	0.256	0.156	215702	0.248	0.153
backward	244261	0.258	0.074	215702	0.257	0.076
forward	244261	0.304	0.073	215702	0.305	0.073
employment based						
horizontal	227937	0.189	0.148	200659	0.183	0.145
backward	227937	0.223	0.086	200659	0.222	0.087
forward	227937	0.246	0.074	200659	0.247	0.074

Table 4.3: Summary statistics for the full and domestic sample

Forward captures the idea that domestic firms who buy inputs from foreign firms might benefit from higher quality inputs and might benefit from demonstration effects. Making the same assumptions as above we define *Forward* as:

$$Forward_{jt} = \sum_{l \ if \ l \neq j} \delta_{jlt} Horizontal_{lt} \tag{4.19}$$

here δ_{jlt} are coefficients that indicate the share of sector j inputs purchased from upstream sectors l. The δs are again obtained from the input-output tables. Again, we exclude inputs purchased within the firm's sector ($l \neq j$) because this is captured by *Horizontal*.[13]

As indicated above we will consider the interaction of absorptive capability (AC) with *Horizontal*, *Backward*, and *Forward*. Since we have no readily available measure for AC, we need to construct a measure. Absorptive capability should reflect the relative technical capabilities of a domestic firm vis-a-vis the foreign firms. Therefore we apply the Levinsohn-Petrin technique on earlier years (to avoid endogeneity) on the full sample of both domestic and

[13]Consider the following example for three sectors j, l_1, and l_2. Suppose j buys 75% of its inputs with l_1 and the remaining 25% with l_2. Further suppose that 10% of l_1's output is produced by foreign firms, and half of the output of l_2 is produced by foreign firms. The backward variable for sector j then becomes: $(0.75 * 0.10) + (0.25 * 0.50) = 0.20$.

	(1)	(2)	(3)	(4)
	output		*employment*	
	dummy	*percentage*	*dummy*	*percentage*
horizontal	-0.044	0.148	0.585	0.900
	[1.02]	[2.69]***	[16.65]***	[17.26]***
backward	-1.011	-1.312	-1.260	-1.378
	[21.12]***	[21.53]***	[27.10]***	[22.25]***
forward	3.250	4.203	2.491	5.111
	[50.68]***	[53.67]***	[40.35]***	[49.24]***
Herfindahl	-1.231	-1.167	-1.390	-1.244
	[8.64]***	[8.19]***	[9.90]***	[8.88]***
Observations	192851	192851	192851	192851
Number of firms	72365	72365	72365	72365
R-squared	0.03	0.03	0.03	0.04

Absolute value of t statistics in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4.4: Horizontal and vertical spillovers: level effects

foreign firms to create total factor productivity measures φ for all firms. We then define in (4.20) the absorptive capability of a firm as the distance between its own productivity level and the 'foreign frontier'. The latter is defined as the mean productive efficiency of the top quartile of foreign firms (above the 75th percentile in θ) in industry j. The higher the value of AC, the more advanced the firm.

$$AC_{ijrt} = \frac{\varphi_{ijrt}}{\overline{\varphi}_{j,FOR}|_{\theta>0.75}} \tag{4.20}$$

Table 4.3 gives summary statistics for the variables described above. Notewhorty is that the output based measures for spillovers are larger than the employment based measures. This is due to the fact that some domestic firms, especially in manufacturing, tend to be overstaffed, a heritage from the communist era.

4.6 Results and interpretation

Table 4.4 shows how firm productivity is explained by spillover effects. In column 1 and 3 the measures of foreign presence are based on the dummy-version of (4.17), (4.18) and (4.19); in columns 2 and 4 the percentage-versions are used. Columns 1 and 2 show results for the output based measures, 3 and 4 for the employment based counterparts.[14] The first result that catches

[14] We performed the regressions with only manufacturing sectors as well, results are not presented here, but available on demand.

	(1)	(2)	(3)	(4)
	output		*employment*	
	dummy	*percentage*	*dummy*	*percentage*
horizontal	-0.500	-0.021	1.098	1.080
	[4.82]***	[0.17]	[13.35]***	[10.69]***
horizontal²	0.484	0.000	-0.939	-0.000
	[3.62]***	[0.81]	[8.40]***	[3.91]***
backward	-0.735	-1.171	-2.858	-4.034
	[5.09]***	[6.37]***	[23.77]***	[26.30]***
backward²	-0.498	0.410	4.253	9.340
	[1.47]	[0.71]	[14.85]***	[19.41]***
forward	10.332	15.535	4.815	9.954
	[44.07]***	[57.67]***	[21.97]***	[35.14]***
forward²	-12.422	-27.637	-4.572	-16.146
	[31.39]***	[43.96]***	[11.69]***	[19.90]***
Herfindahl	-1.028	-0.849	-1.370	-1.080
	[7.19]***	[5.96]***	[9.73]***	[7.71]***
Observations	192851	192851	192851	192851
Number of firms	72365	72365	72365	72365
R-squared	0.04	0.05	0.04	0.04

Absolute value of t statistics in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4.5: Horizontal and vertical spillovers: non-linear effects

the eye is the dominance of intersectoral spillovers over sectoral spillovers. It cannot be rejected that vertical effects are economically more important than horizontal effects. This conclusion is supported in all the following results. Clearly research on spillovers needs to be re-oriented in this direction. The horizontal spillovers, the effect of the presence of foreign firms in the sector, remain unclear in table 4.4 because the direction and significance of horizontal spillovers is not consistent across specifications. This fits the ambiguous results in the literature. There is however a consistent positive forward spillover effect to local enterprises in all specifications. This means that Romanian firms benefit from foreign presence in the industries they buy their inputs from. Both service and manufacturing sectors are found to benefit from foreign presence in their input sectors, probably through better inputs. The backward spillover, the effect of foreign presence in the sectors to whom you sell, is negative for all sectors, although the results are less explicit if we restrict attention to manufacturing sectors.

In table 4.5 we allow for non-linear effects. The results suggest that spillovers are highly non-linear indeed. In figure 4.2 we plot the relations found in table 4.5. The vertical lines indicate the 95th percentile of the distribution of the corresponding spillover. The sign and direction of horizontal spillovers are still mixed in the specifications considered. The larger and more clearly positive

	(1)	(2)	(3)	(4)
	output		*employment*	
	dummy	*percentage*	*dummy*	*percentage*
horizontal	-0.459	-0.057	0.896	0.874
	[3.49]***	[0.38]	[8.17]***	[6.35]***
horizontal²	0.640	0.000	-0.581	-0.000
	[3.69]***	[2.22]**	[3.54]***	[0.89]
AC*horizontal	0.592	0.442	0.917	0.980
	[0.76]	[0.52]	[1.46]	[1.30]
AC*horizontal²	-2.273	-0.000	-1.835	-0.000
	[1.96]*	[1.87]*	[1.84]*	[1.30]
AC²*horizontal	-0.246	-0.316	-0.287	-0.369
	[0.28]	[0.33]	[0.40]	[0.42]
AC²*horizontal²	1.243	0.000	0.409	0.000
	[0.94]	[1.05]	[0.37]	[0.22]
backward	-1.780	-2.844	-3.169	-4.453
	[8.89]***	[11.41]***	[18.56]***	[20.16]***
backward²	3.006	7.327	6.341	12.821
	[6.39]***	[9.37]***	[15.76]***	[18.40]***
AC*backward	8.651	13.108	1.814	2.089
	[6.88]***	[8.66]***	[1.52]	[1.39]
AC*backward²	-30.791	-57.744	-16.691	-26.751
	[10.46]***	[12.26]***	[5.99]***	[5.55]***
AC²*backward	-6.939	-9.619	-0.212	0.227
	[4.97]***	[5.85]***	[0.15]	[0.13]
AC²*backward²	26.327	45.856	12.167	18.050
	[8.17]***	[9.23]***	[3.76]***	[3.36]***
forward	9.728	15.128	3.734	8.461
	[35.77]***	[47.59]***	[14.55]***	[24.65]***
forward²	-10.768	-25.682	-1.294	-8.904
	[22.55]***	[33.29]***	[2.67]***	[8.41]***
AC*forward	4.826	2.203	10.301	12.989
	[3.68]***	[1.40]	[8.57]***	[7.45]***
AC*forward²	-13.429	-12.740	-30.293	-64.140
	[5.22]***	[3.07]***	[11.24]***	[10.01]***
AC²*forward	-2.728	-0.370	-8.410	-10.073
	[1.86]*	[0.21]	[6.00]***	[4.93]***
AC²*forward²	7.344	4.161	23.284	45.869
	[2.51]**	[0.88]	[7.21]***	[5.96]***
Herfindahl	-1.046	-0.876	-1.436	-1.142
	[7.29]***	[6.09]***	[10.21]***	[8.16]***
Observations	192851	192851	192851	192851
Number of firms	72365	72365	72365	72365
R-squared	0.04	0.05	0.04	0.05
F tests				
No AC-horizontal	6.09***	5.92***	4.69***	2.16*
No AC-backward	47.28***	57.41***	65.26***	54.64***
No AC-forward	28.08***	23.12***	75.30***	64.21***
No horizontal	7.63***	4.66***	39.83***	36.18***
No backward	100.58***	90.99***	194.55***	178.43***
No forward	604.67***	812.56***	306.46***	442.57***

Absolute value of t statistics in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%; F tests: "No AC-X" tests whether all interactions are jointly equal to zero, "No X" tests whether the level and the square of X and all interactions are jointly equal to zero.

Table 4.6: Horizontal and vertical spillovers: non-linear effects conditional on absorptive capability

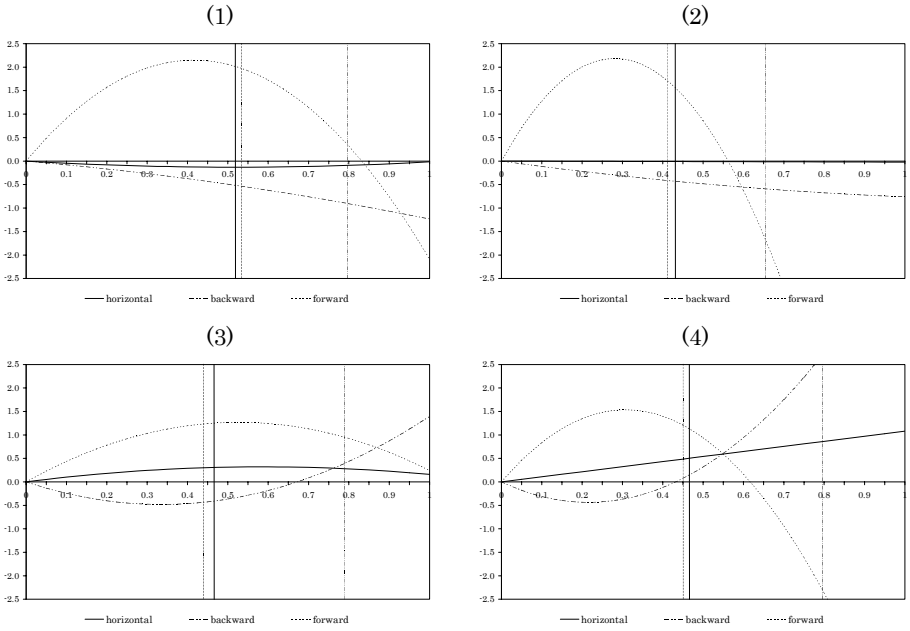

Figure 4.2: Non-linear intra- and intersectoral effect of foreign participation: horizontal, backward and forward spillovers (numbers above panels correspond to column headings in table 4.5; the vertical axis indicates the effect on TFP, the horizontal axis indicates the level of foreign participation in repectively the own sector and linked sectors; vertical lines indicate 95th percentile of the distribution of the corresponding spillover)

effects in the employment specifications (3 and 4) suggest that any positive horizontal effects run over the labour market, rather than through improved competition or something of the sort. Forward spillovers consistently show an inverted U shape in all specifications. The large majority of firms benefits from foreign presence in their input sectors. Backward spillovers are clearly negative in the output specifications and show a U-shape in the employment specifications, which partially corrects the finding in table 4.4 of negative backward spillovers. Apparently, selling to sectors with high foreign presence has a positive effect on total factor productivity, provided the foreign presence is high enough. If the foreign presence remains relatively low, the negative effects are found.

Table 4.6 adds interactions with absorptive capability. The explanatory power is higher than in table 4.4. The interaction effects with absorptive capability are significant for all three spillover effects. Still for horizontal spillovers

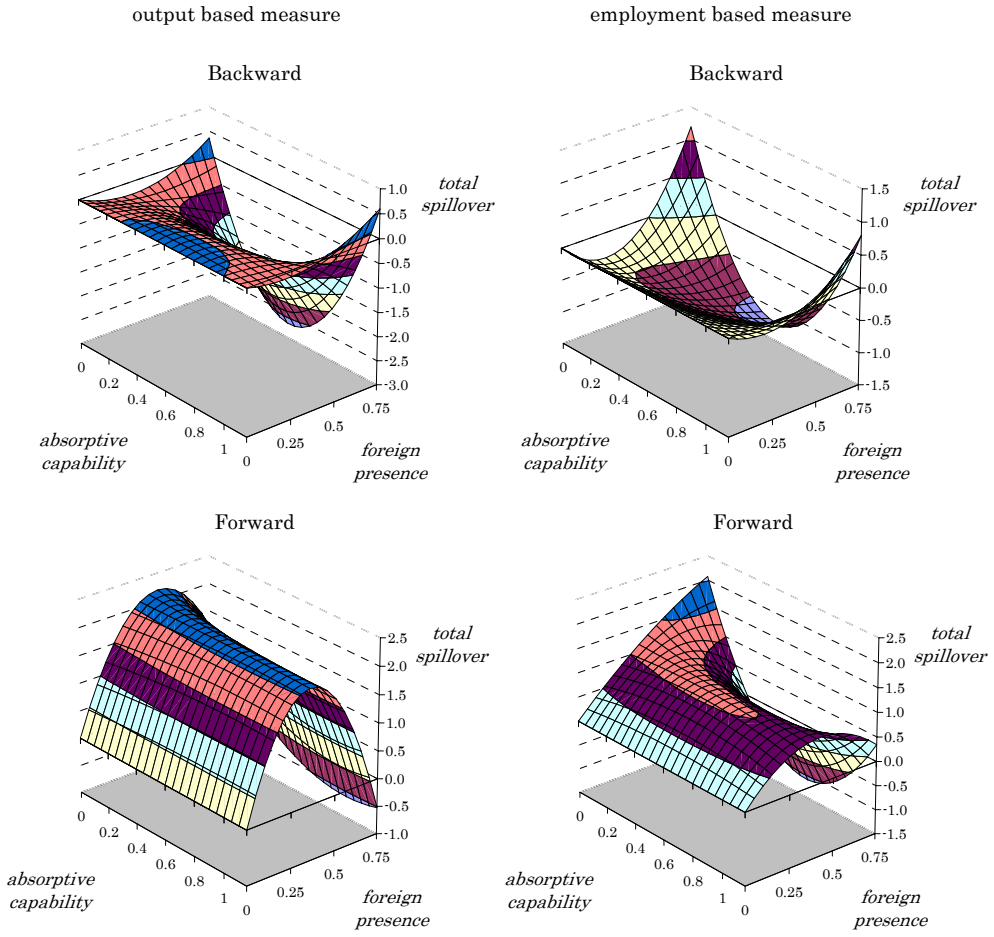

Figure 4.3: Forward and backward spillover effects: non-linear effects conditional on absorptive capability

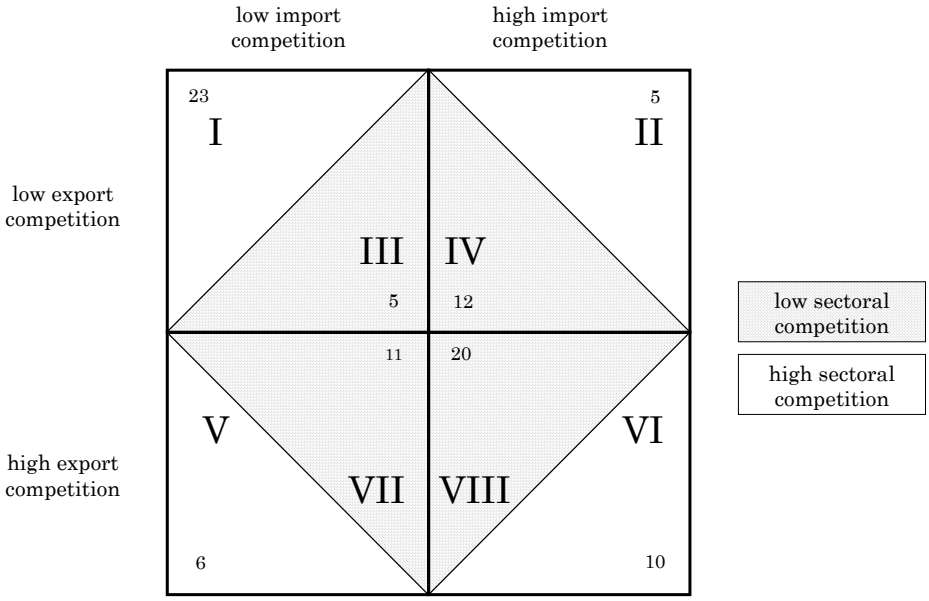

Figure 4.4: Split-up of sectors based on export orientation, competition from imports, and sectoral competition (arabic numerals indicates the number of sectors falling into each category)

there seems to be not really much of interaction with absorptive capability (relatively low scores on the F-test), and the results are still very mixed across specifications. The results for backward and forward spillovers are much more interesting though. We show the implied relations in figure 4.3. Backward spillovers are very positive if foreign presence in the downstream sector is high and if the absorptive capability is either low enough or high enough. The last part of this assertion (positive backward spillovers if absorptive capability is high enough) supports the theory Rodríguez-Clare (1996). Forward spillovers also show an interesting though more stable pattern, certainly for the output definition. Absorptive capability only plays a minor role if foreign presence is low. With increasing foreign presence the role of absorptive capability increases. Clearly the inverted U-shape found for forward spillovers in figure 4.2 and table 4.4 depends on the level of absorption. The inverted U-shape arises and becomes more pronounced with higher absorptive capability.

Still the found spillovers may be misspecified, since they may depend on other factors such as openness (import competition, export orientation) and sectoral competition, as suggested in the literature. To verify this conjecture, we split our sample in 8 subsamples as shown in figure 4.4. The level of

	export orientation	import competition	sectoral competition	spillover (dummy/percentage) horizontal	backward	forward
I	low	low	high	-***/-***	-***/-***	+***/+***
II	low	high	high	+***/+***	-***/-***	+***/-***
III	low	low	low	+/+	-*/-***	+**/+*
IV	low	high	low	+**/+*	+/+	-/-
V	high	low	high	-***/-***	+***/+***	+***/+***
VI	high	high	high	-***/-	+***/+**	+***/+***
VII	high	low	low	-**/-	-***/-*	-*/-***
VIII	high	high	low	-***/-***	-***/-**	-/+

Table 4.7: Level effects of horizontal and vertical spillovers after sector split-up

sectoral competition is measured by our Herfindahl index (*cf. supra*). Export orientation is measured by total sectoral exports as a percentage of sectoral output. Import competition is measures by imports of products comparable to the produce of the sector scaled by total sectoral output. Exports and imports of comparable products are taken from the input-output tables.

Theory leads to some clear predictions. *i*) Sectors with low sectoral competition (areas III, IV, VII, and VIII in figure 4.4) should not experience positive horizontal spillover effects, because they are not used to external competition. The market stealing effect should therefore dominate, although this may depend on absorptive capability. *ii*) Horizontal spillovers are expected to be mainly positive in sectors with high competition, certainly if these sectors are still relatively closed (areas I, II and V). This has been called the demonstration effect. *iii*) Rodriguez-Clare (1996) shows that backward spillover effects should be positive if the inputs required are not too different from the ones already produced by the local firms. This is likely to be case in the export-oriented sectors. Firms in these sectors are already used to the required quality on export markets and will more easily adapt to the demand from foreign firms in downstream sectors. This will especially be the case when there is high sectoral competition (areas V and VI). *iv*) Better inputs through forward spillover effects will tend to be beneficial overall. The effect is, however, expected to be more beneficial to closed sectors than to open sectors. Indeed the presence of better local inputs should mainly improve productivity in closed sectors. Sectors that export a large share of their produce need to produce high quality and will have been forced before to buy better foreign inputs if local input quality is too low. So they will at best only benefit marginally from the better local

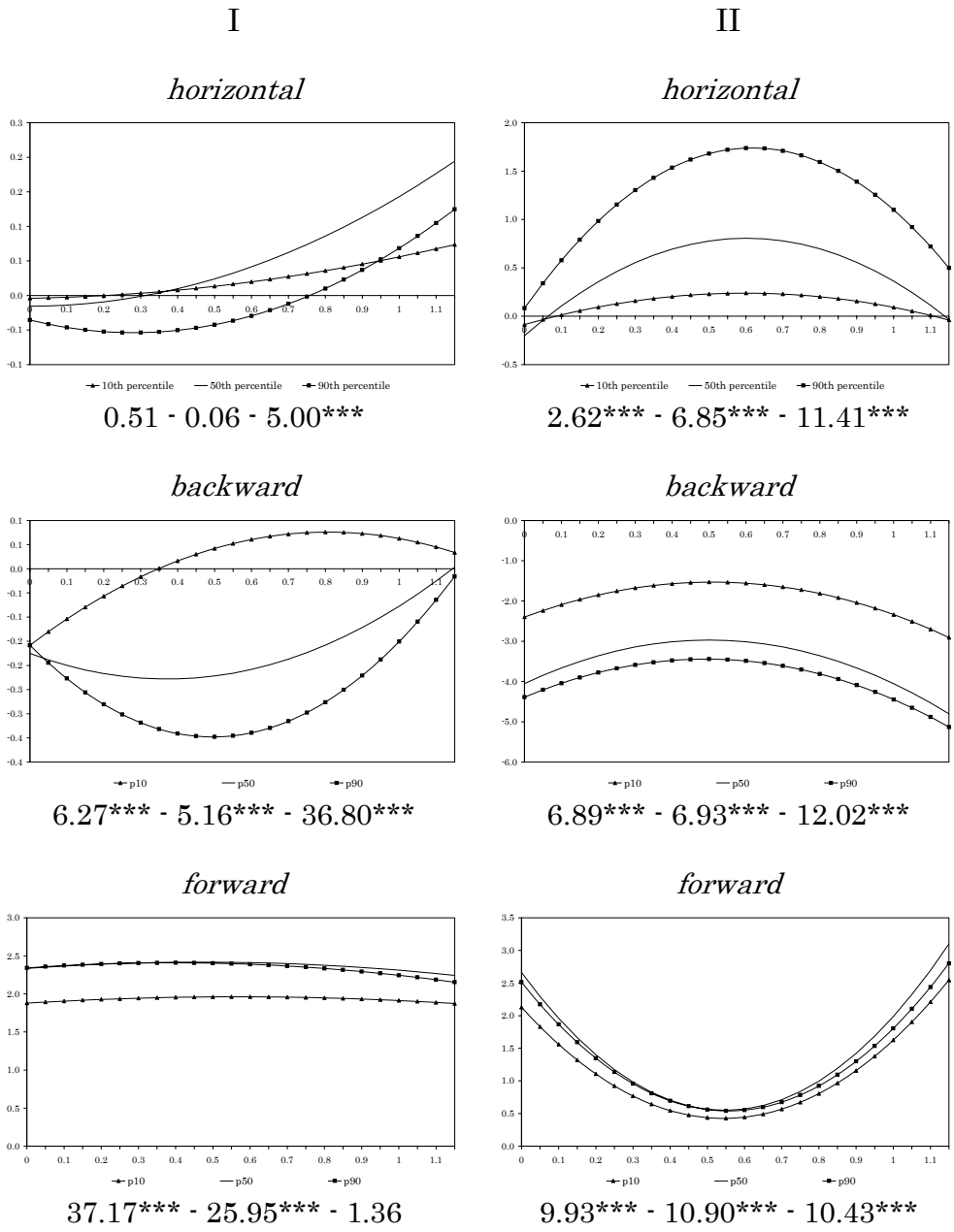

Figure 4.5: Non-linear horizontal and vertical spillovers interacted with absorptive capability after sector split-up - sectors in I and II (absorptive capability on horizontal axis, spillover effect on vertical axis; top figure is always horizontal, middle figure backward, and bottom figure forward effect; different lines indicate percentiles of spillover variables: 10th - solid line with triangles, 50th - solid line, and 90th percentile - solid line with squares; numbers indicate t-stat for level impact of spillover variable, t-stat for squared impact of spillover variable, and F test for joint significance of the interactions with absorptive capability)

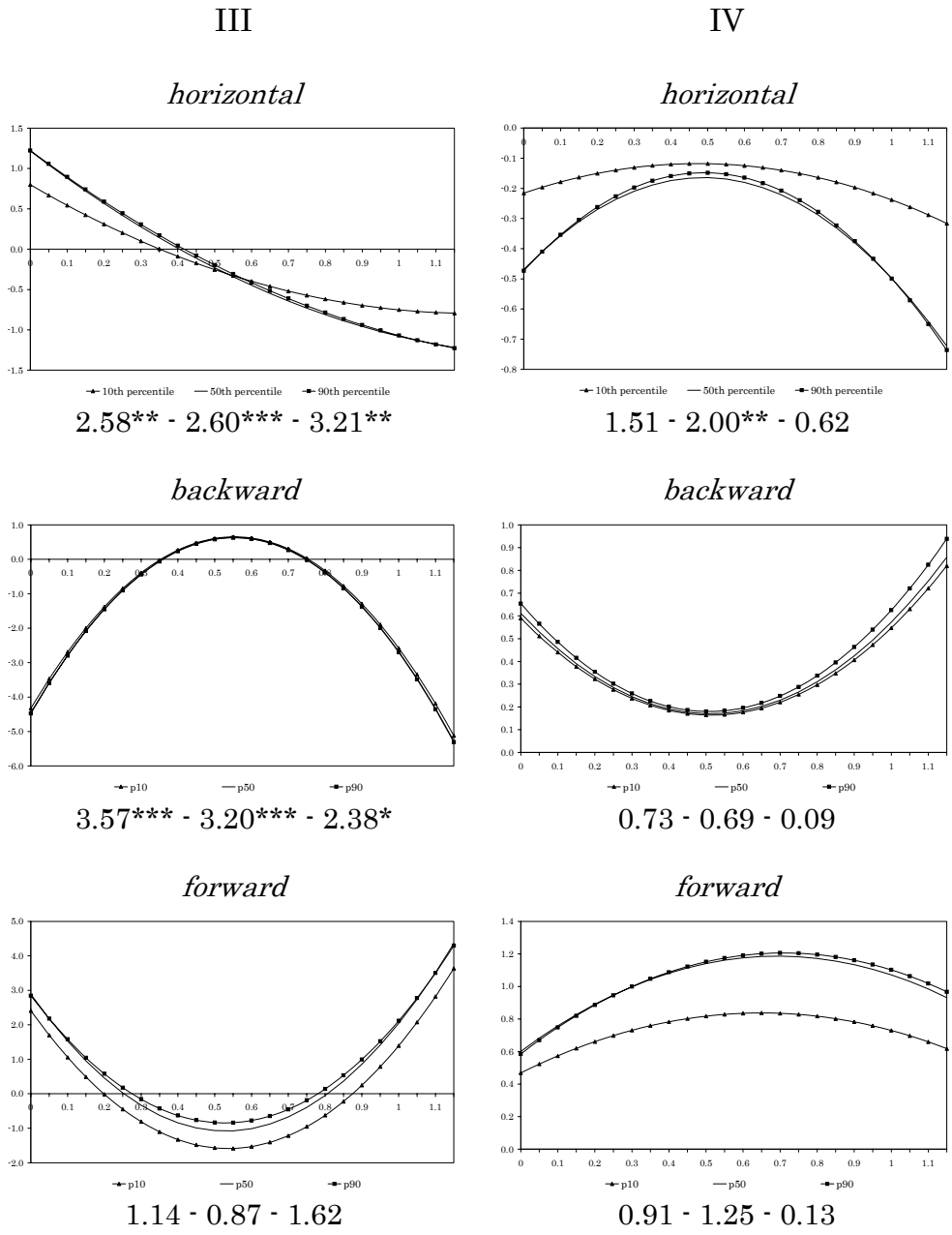

Figure 4.6: Non-linear horizontal and vertical spillovers interacted with absorptive capability after sector split-up - sectors in III and IV (absorptive capability on horizontal axis, spillover effect on vertical axis; top figure is always horizontal, middle figure backward, and bottom figure forward effect; different lines indicate percentiles of spillover variables: 10th - solid line with triangles, 50th - solid line, and 90th percentile - solid line with squares; numbers indicate t-stat for level impact of spillover variable, t-stat for squared impact of spillover variable, and F test for joint significance of the interactions with absorptive capability)

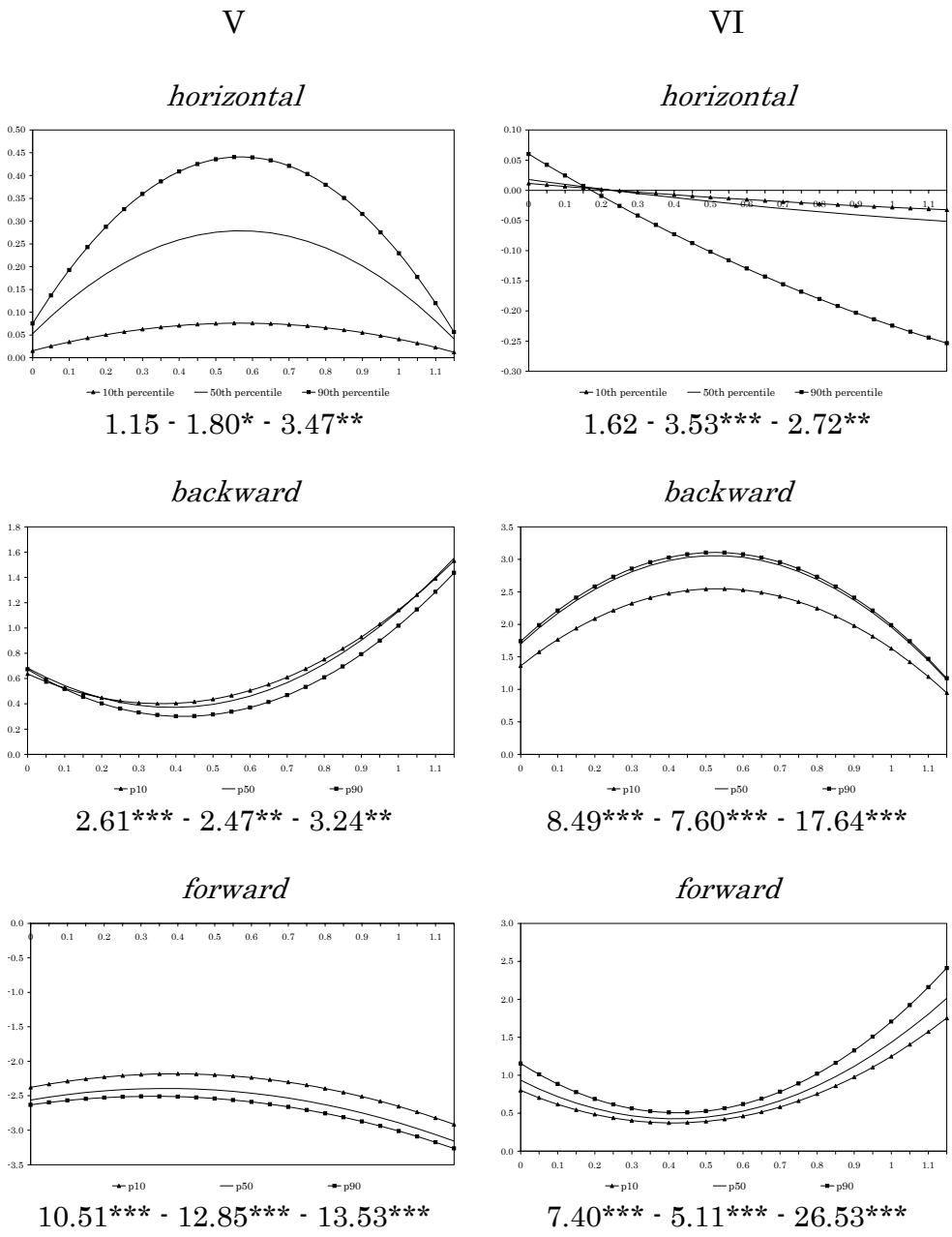

Figure 4.7: Non-linear horizontal and vertical spillovers interacted with absorptive capability after sector split-up - sectors in V and VI (absorptive capability on horizontal axis, spillover effect on vertical axis; top figure is always horizontal, middle figure backward, and bottom figure forward effect; different lines indicate percentiles of spillover variables: 10th - solid line with triangles, 50th - solid line, and 90th percentile - solid line with squares; numbers indicate t-stat for level impact of spillover variable, t-stat for squared impact of spillover variable, and F test for joint significance of the interactions with absorptive capability)

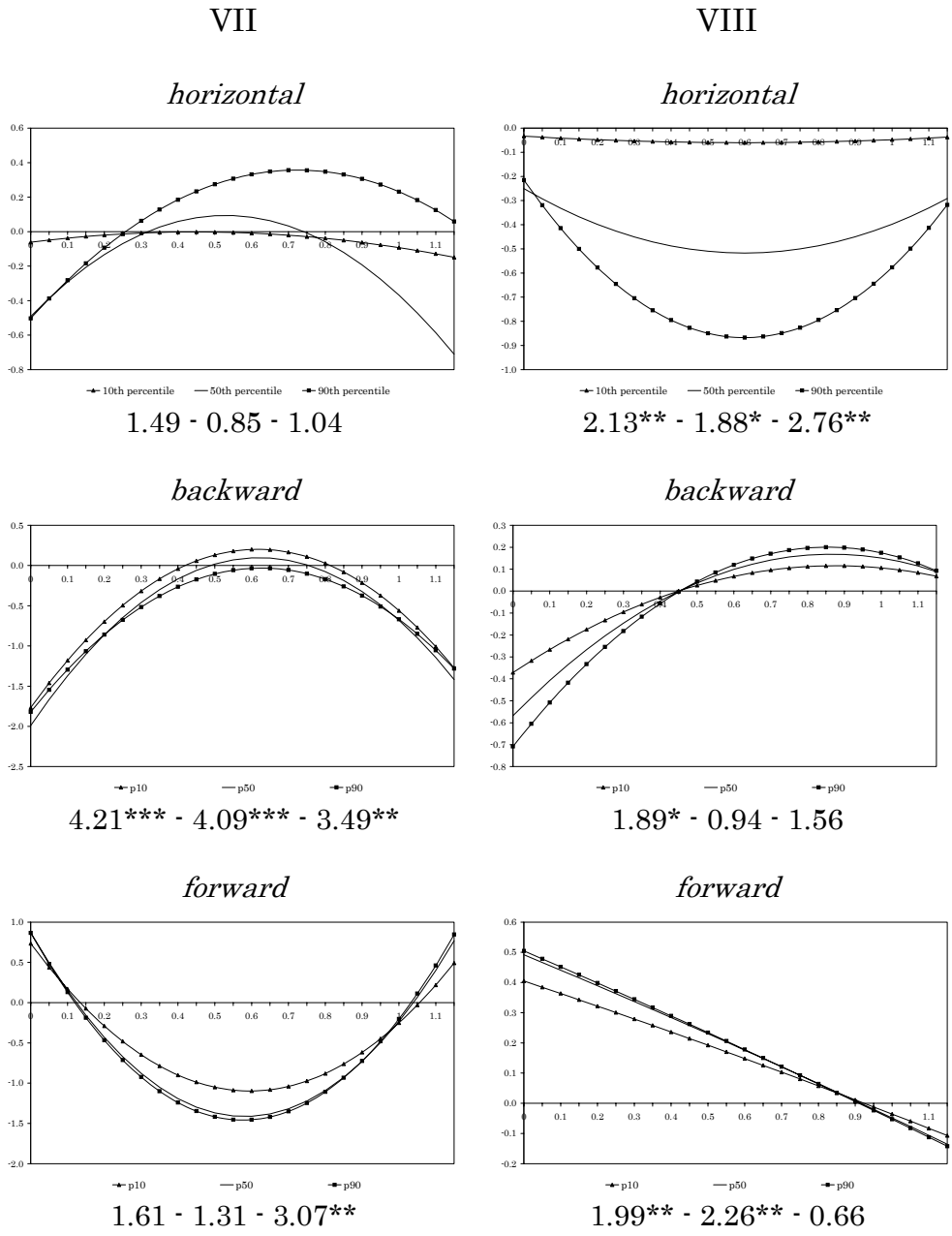

Figure 4.8: Non-linear horizontal and vertical spillovers interacted with absorptive capability after sector split-up - sectors in VII and VIII (absorptive capability on horizontal axis, spillover effect on vertical axis; top figure is always horizontal, middle figure backward, and bottom figure forward effect; different lines indicate percentiles of spillover variables: 10th - solid line with triangles, 50th - solid line, and 90th percentile - solid line with squares; numbers indicate t-stat for level impact of spillover variable, t-stat for squared impact of spillover variable, and F test for joint significance of the interactions with absorptive capability)

inputs. Therefore we expect positive forward spillovers in sectors belonging to areas I, II, III and IV.

Results are shown in table 4.7 and figures 4.5, 4.6, 4.7, and 4.8. We repeated the settings from columns 1 and 2 of table 4.4 for all quadrants in figure 4.4. Results are summarized in table 4.7. From this table it seems that only the third prediction is sustained by the data. But this is due to the failure to take non-linearities and absorptive capacity into account. In figures 4.5, 4.6, 4.7, and 4.8 we show the results of applying the setting from column 1 in table 4.6 to the 8 quadrants. The figures show for every regression three subfigures with the horizontal, backward, and forward effect as a function of absorptive capability. The solid line refers to the effect at the 50th percentile of the distribution of $horizontal$, $backward$, and $forward$ respectively. The solid lines with triangles and squares refer to the 10th and 90th percentile. The numbers below each subfigure correspond to the t-statistic for the level coefficient, the t-statistic for the quadratic coefficient, and the F-test for joint significance of the interactions with absorptive capability. Inspection of figures 4.5 through 4.8 learns that none of the four hypotheses can be rejected any longer. In line with hypotheses *i* and *ii* horizontal spillovers are found to be non-positive in the uncompetitive areas III, IV, VII, and VIII; but mainly positive in the competitive but relatively closed sectors in areas I, II and V. For sectors in area VI the horizontal effect is nearly zero, except for firms with high absorptive capability in those sectors with the highest levels of foreign penetration. The latter firms experience a negative effect. The effect is however tiny when compared to the other areas (compare the scaling on the vertical axis with those in the other figures). The backward spillover is positive in the highly competitive export-oriented sectors in areas V and VI, confirming hypothesis *iii*. In area V the most advanced firms benefit the most from foreign presence in downstream sectors. In area VI, the most competitive sectors in every respect, we find an inverse U-shaped relationship. The firms with the highest absorptive capability have less to gain than those with medium absorptive capability. These firms do benefit the most, however, from the availability of better inputs as can be seen from the subfigure with the forward spillovers. For the export-oriented sectors with low competition, the backward spillover is insignificant for sectors in area VIII and it is largely negative for sectors in area VII. In the latter area, only firms with medium absorptive capability

	(1) $L<5$	(2) $5<L<50$	(3) $5<L<100$	(4) $L>50$	(5) $L>100$
horizontal	-0.409	-0.709	-0.658	0.605	0.583
	[1.90]*	[3.43]***	[3.37]***	[1.57]	[1.22]
horizontal²	0.348	1.283	1.280	-1.495	-1.831
	[1.25]	[4.65]***	[4.89]***	[2.82]***	[2.90]***
AC*horizontal	-3.709	1.067	1.171	-5.078	-4.741
	[2.50]**	[0.95]	[1.12]	[2.88]***	[2.22]**
AC*horizontal²	3.393	-2.959	-3.470	7.546	8.959
	[1.52]	[1.78]*	[2.24]**	[2.87]***	[2.84]***
AC²*horizontal	3.908	-0.544	-0.385	4.086	2.862
	[2.13]**	[0.44]	[0.34]	[2.43]**	[1.42]
AC²*horizontal²	-4.299	1.576	1.732	-6.185	-6.150
	[1.56]	[0.84]	[1.00]	[2.41]**	[1.97]**
backward	-1.703	-3.002	-3.007	-2.893	-3.491
	[5.51]***	[8.65]***	[9.13]***	[3.83]***	[3.99]***
backward²	3.581	7.004	6.804	4.564	5.519
	[4.73]***	[8.75]***	[9.06]***	[3.06]***	[3.19]***
AC*backward	14.632	15.821	16.428	10.922	12.110
	[5.96]***	[7.56]***	[8.53]***	[3.71]***	[3.57]***
AC*backward²	-57.927	-52.593	-52.251	-17.991	-17.448
	[9.17]***	[10.60]***	[11.68]***	[3.30]***	[2.88]***
AC²*backward	-12.254	-11.548	-12.993	-9.065	-8.947
	[3.75]***	[4.89]***	[6.29]***	[3.40]***	[2.93]***
AC²*backward²	55.378	38.939	41.060	14.250	12.379
	[6.47]***	[6.68]***	[8.43]***	[2.98]***	[2.37]**
forward	10.900	8.213	7.766	-1.385	-1.539
	[24.63]***	[17.62]***	[17.75]***	[1.66]*	[1.48]
forward²	-11.992	-9.205	-8.684	6.012	6.926
	[15.80]***	[11.04]***	[11.11]***	[4.16]***	[3.82]***
AC*forward	8.544	0.836	-0.418	0.856	-1.236
	[3.52]***	[0.41]	[0.22]	[0.26]	[0.31]
AC*forward²	-20.291	-5.217	-2.612	-8.915	-8.063
	[4.09]***	[1.31]	[0.71]	[1.52]	[1.13]
AC²*forward	-7.267	0.681	2.110	0.632	1.992
	[2.39]**	[0.31]	[1.05]	[0.21]	[0.55]
AC²*forward²	13.472	0.755	-2.176	5.125	4.913
	[2.11]**	[0.17]	[0.55]	[0.91]	[0.73]
Herfindahl	-1.919	-0.060	-0.098	0.409	0.549
	[7.73]***	[0.27]	[0.47]	[1.55]	[1.66]*
Observations	96936	67824	74615	15222	8728
Number of firms	45727	28478	30190	5780	3363
R-squared	0.06	0.05	0.05	0.06	0.08
No AC-horizontal	4.08***	3.94***	6.09***	3.65***	4.31***
No AC-backward	41.13***	63.49***	64.15***	6.22***	7.40***
No AC-forward	13.72***	6.72***	7.84***	2.34**	4.22***
No horizontal	6.11***	6.41***	7.66***	5.74***	6.98***
No backward	52.00***	68.13***	72.09***	22.59***	19.08***
No forward	250.68***	177.23***	182.11***	3.95***	3.30***

Absolute value of t statistics in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4.8: Horizontal and vertical spillovers: sensitivity to firm size

	(1)		(2)		(3)		
	full	partial	majority†	minority	full	majority‡	minority
horizontal	-0.328	-0.903	-0.611	-0.650	-0.190	-0.885	-0.560
	[3.79]***	[14.55]***	[10.48]***	[5.59]***	[2.12]**	[12.77]***	[4.71]***
backward	-0.299	-1.765	-1.538	2.573	-0.880	-2.605	1.929
	[2.99]***	[18.58]***	[21.12]***	[9.17]***	[8.12]***	[22.69]***	[6.85]***
forward	-0.953	4.589	3.631	1.456	-0.613	4.982	2.461
	[8.35]***	[66.41]***	[53.94]***	[5.68]***	[5.29]***	[68.00]***	[9.62]***
Herf3	-0.649		-0.000		-0.000		
	[4.56]***		[10.09]***		[4.58]***		
Observations	192851		192851		192851		
R-squared	0.05		0.04		0.05		
Equal horizont.	39.37***		0.11		21.98***		
Equal backward	76.45***		155.90***		129.39***		
Equal forward	2061.77***		66.94***		1082.89***		

Absolute value of t statistics in brackets, ** significant at 5%; *** significant at 1%
† majority: foreign share > 50%; ‡ majority: foreign share > 50% **and** < 95%

Table 4.9: Horizontal and vertical spillovers: full versus partial ownership and minority versus majority ownership

seem to benefit, provided the foreign penetration in downstream sectors is not too high. It seems therefore that export orientation cannot compensate for the low sectoral and import competition. The fact that the backward spillover is insignificant in area VIII with high import, but low sectoral competition, also lends support to this hypothesis. For the less export-oriented sectors in areas I, II, and III the backward spillover is largely negative, for area IV, it is positive but fully insignificant. Non-negative forward spillovers are found for sectors in areas I, II, III and IV. Generally, the firms with higher absorptive capability do not benefit less than those with medium to low absorptive capability. The only odd observation is that forward spillovers tend to be negative in sectors with high export orientation but low import competition (sectors V and VII). We have no explanation for this finding.

In two last steps, we verify whether spillovers depend on the scale of the firm and on the magnitude of foreign presence. Results are shown in table 4.8, 4.9, and 4.10. In table 4.8 we see that mainly horizontal and forward effects depend on the scale of the firm.[15] Horizontal spillovers switch from a U-shape to inverted U-shape with increasing scale and forward spillovers show exactly the opposite pattern. The backward spillover pattern seems to be relatively constant with increasing scale. For small firms the interaction effects with absorptive capability are strongly present for forward spillovers. Though F-tests

[15] The results displayed are for the dummy-output based measures of foreign presence.

	[1]		[2]		[3]		
	full	partial	majority†	minority	full	majority‡	minority
horizontal	-0.696	-2.385	-4.387	3.123	-0.797	-3.644	1.727
	[3.32]***	[10.65]***	[20.80]***	[7.37]***	[3.74]***	[15.47]***	[4.03]***
horizontal²	1.793	2.824	6.452	-12.956	1.895	4.690	-8.167
	[3.79]***	[6.82]***	[19.37]***	[6.97]***	[3.99]***	[10.92]***	[4.39]***
AC*horizontal	1.325	-6.545	7.548	-15.808	2.801	0.120	-4.840
	[1.15]	[4.95]***	[6.68]***	[5.94]***	[2.39]**	[0.09]	[1.84]**
AC*horizontal²	-10.435	7.367	-16.098	28.014	-11.514	-1.646	-13.447
	[3.82]***	[2.77]***	[8.18]***	[2.10]**	[4.20]***	[0.59]	[1.02]
AC²*horizontal	-1.915	6.481	-6.361	12.421	-3.283	1.465	3.004
	[1.48]	[4.46]***	[5.11]***	[4.03]***	[2.48]**	[0.95]	[0.98]
AC²*horizontal²	8.584	-7.978	12.933	-18.024	9.735	-1.350	17.173
	[2.80]***	[2.79]***	[6.05]***	[1.11]	[3.16]***	[0.44]	[1.06]
backward	-4.804	3.330	-1.679	-3.620	-2.942	6.686	-16.850
	[8.76]***	[5.87]***	[4.24]***	[2.06]**	[5.19]***	[9.28]***	[9.33]***
backward²	18.711	-11.042	2.304	108.046	9.921	-29.469	243.322
	[9.61]***	[5.48]***	[2.57]**	[6.05]***	[4.82]***	[10.12]***	[12.98]***
AC*backward	-4.380	20.887	11.154	11.289	2.265	-8.355	63.996
	[1.44]	[6.23]***	[4.80]***	[1.18]	[0.71]	[2.09]**	[6.59]***
AC*backward²	-23.187	-92.820	-45.803	-238.089	-38.425	5.886	-791.746
	[2.32]**	[7.78]***	[8.68]***	[2.55]**	[3.70]***	[0.36]	[8.18]***
AC²*backward	8.604	-22.032	-10.141	2.447	1.176	2.185	-47.100
	[2.86]***	[6.45]***	[3.90]***	[0.22]	[0.37]	[0.54]	[4.28]***
AC²*backward²	4.881	95.363	40.484	89.788	21.831	18.144	610.160
	[0.55]	[8.16]***	[7.09]***	[0.85]	[2.31]**	[1.17]	[5.63]***
forward	14.855	1.938	8.842	30.817	12.281	2.416	15.016
	[29.46]***	[3.67]***	[23.30]***	[22.02]***	[22.93]***	[4.71]***	[10.50]***
forward²	-46.350	5.908	-11.880	-245.608	-40.359	4.487	-79.298
	[31.24]***	[3.81]***	[15.54]***	[18.38]***	[25.53]***	[2.31]**	[5.88]***
AC*forward	-5.595	24.028	24.740	-120.579	15.991	26.718	-83.500
	[1.71]**	[7.52]***	[10.73]***	[11.79]***	[4.51]***	[7.76]***	[8.12]***
AC*forward²	5.355	-90.524	-48.091	973.171	-48.126	-117.571	553.493
	[0.51]	[9.76]***	[10.34]***	[9.53]***	[4.34]***	[9.21]***	[5.49]***
AC²*forward	5.937	-18.322	-20.960	108.766	-11.316	-22.173	72.173
	[1.52]	[4.93]***	[7.68]***	[8.71]***	[2.67]***	[5.39]***	[5.75]***
AC²*forward²	-11.261	65.939	38.336	-894.233	30.697	91.729	-508.761
	[0.89]	[6.04]***	[7.01]***	[7.09]***	[2.29]**	[5.97]***	[4.09]***
Herfindahl	-0.000		-0.000			0.000	
	[0.36]		[6.15]***			[0.18]	
Observations	192851		192851			192851	
R-squared	0.08		0.06			0.08	
Equal horizontal	35.69***		48.55***			25.88***	
Equal backward	51.06***		70.95***			56.60***	
Equal forward	407.50***		176.79***			118.47***	

Absolute value of t statistics in brackets, * significant at 10%; ** significant at 5%; *** significant at 1%

† majority: foreign share > 50%; ‡ majority: foreign share > 50% **and** < 95%

Table 4.10: Horizontal and vertical spillovers: full versus partial ownership and minority versus majority ownership - interactions with absorptive capability

reject that all interactions together do not matter for medium and large firms, one can infer from the individual t-stats that the impact is estimated imprecise. In table 4.9 on page 137 we calculate different spillovers. In specification (1) we use a spillover for full ownership (more than 95%) and one for partial ownership (less than 95%). In specification (2) we use a spillover for majority ownership (more than 50%) and for minority ownership (less than 50%). Finally, in specification (3) we use a spillover full ownership (more than 95%), for a second type of majority ownership (more than 50%, but less than 95%) and for minority ownership (less than 50%) The results are very intuitive. Fully owned foreign firms do not generate any positive spillover effects. They probably have limited or no contacts with local firms and source their inputs either abroad or with other foreign firms. In the second specification we observe that we cannot reject that the horizontal spillovers are identical from majority and minority owned foreign firms. Interestingly, however, in specification (2) and (3) the backward spillover is positive for spillovers from minority owned foreign firms, while it is negative for spillovers from majority owned foreign firms. This is logical since minority foreign owned firms are dominated by locals and therefore are much more likely to buy local resources. This leads to positive backward spillovers. In table 4.10 on page 138 we repeat the regressions of table 4.9 including non-linearities and interaction terms with absorptive capability. The resulting spillover effects (figures available on demand) confirm the findings of table 4.9.

4.7 Conclusions

This paper investigates the spillovers within and between sectors from foreign to domestic firms for a comprehensive set of Romanian firms. Contrary to most of the literature our dataset uses a series of input-output tables to take into account changes in economic structure and it contains dynamic ownership data. We further contribute to the literature in several ways. We estimate sectoral production functions using a new and up to date estimation strategy. From the estimation a measure of total factor productivity is recovered. We then use the full sample of all firms in all sectors to relate total factor productivity to different measures of foreign presence. Our results highlight the importance of taking into account non-linearities and conditionalities. The lack of consensus

on the horizontal effect in earlier studies probably originate from failing to do so. We allow for a non-linear effect of foreign presence within and between sectors and show that the effect varies with the absorptive capability of the firm. Further, we split the sample in a novel way according to the following criteria: export orientation, import competition and sectoral competition.

Throughout the paper the results illustrate the dominance of intersectoral spillovers over sectoral spillovers. The interaction effects with absorptive capability are significant for all three spillover effects. Horizontal spillovers are found to be non-positive in uncompetitive sectors, whereas they are mainly positive in the competitive but relatively closed sectors in areas. The backward spillover is positive in highly competitive export-oriented sectors. Firms in these sectors are already used to the required quality on export markets and will more easily adapt to the demand from foreign firms in downstream sectors. This is especially the case when there is high sectoral competition. For the less export-oriented sectors the backward spillover is mainly negative. Non-negative forward spillovers are found for almost all sectors. Generally, the firms with higher absorptive capability do not benefit less than those with medium to low absorptive capability. Mainly horizontal and forward effects are found to depend on the scale of the firm. Horizontal spillovers switch from a U-shape to inverted U-shape with increasing scale, while forward spillovers show exactly the opposite pattern. The backward spillover pattern seems to be relatively stable with increasing scale. Finally, regarding the level of foreign ownership we find that fully owned foreign firms are highly unlikely to generate positive spillover effects. They probably have limited or no contacts with local firms and source their inputs either abroad or with other foreign firms. Horizontal spillovers are identical from majority and minority owned foreign firms, the backward spillover is positive for spillovers from minority owned foreign firms, while it is negative for spillovers from majority owned foreign firms. This is very logical since minority foreign owned firms are dominated by locals and therefore are much more likely to buy local resources.

If anything, our results show "beyond any doubt" that spillovers must be studied between sectors, taking into account non-linearities, and that their direction and magnitude depends on absorptive capability and other conditions. Indeed we consistently found that intersectoral spillovers are economically much larger than sectoral spillovers. The debate in the literature on the

direction and magnitude of spillovers from foreign firms to local firms has only one good answer: it all depends and, reassuringly, it depends in a way that makes economic sense.

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Appendix 4.A Industry code conversion

CODE	INDUSTRY	NACE
01	Vegetal production	01.1 ; 01.3
02	Breeding	01.2 ; 01.3
03	Auxiliary services	01.4
04	Forestry and hunting	02.0 ; 01.5
05	Logging	2
06	Fishing and aquaculture	5
07	Coal mining and processing	10
08	Extraction of petroleum (including auxiliary services)	11.1 ; 11.2
09	Extraction of natural gas (including auxiliary services)	11.1 ; 11.2
11	Ferrous ores quarrying and processing	13.1
12	Non-ferrous ores quarrying and processing	13.2
13	Extraction of building material ores	14.1
14	Extraction of clay and sand	14.2
15	Extraction and processing of chemical ores	14.3
16	Extraction and processing of salt	14.4
17	Other non-ferrous ores quarrying and processing	14.5
18	Meat production and processing	15.1
19	Processing and preserving of fish and fish products	15.2
20	Processing and preserving of fruits and vegetables	15.3
21	Production of vegetal and animal oil and fat	15.4
22	Production of milk products	15.5
23	Production of milling products, starch and starch products	15.6
24	Manufacture of fodder	15.7
25	Processing of other food products	15.8
26	Beverages	15.9
27	Tobacco products	16
28	Textile industry	17
29	Textile clothing	18.1 ; 18.2
30	Manufacture of leather and fur clothes	18.3
31	Footwear and other leather goods	19
32	Wood processing (excluding furniture)	20
33	Pulp, paper and cardboard; related items	21
34	Publishing, printing and reproduction of recorded media	22
35	Coking	23.1
36	Crude oil processing	23.2
38	Basic chemical products	24.1
39	Pesticides and other agrochemical products	24.2
40	Dyes and varnishes	24.3
41	Medicines and pharmaceutical products	24.4
42	Soaps, detergents, upkeeping products, cosmetics, perfumery	24.5
43	Other chemical products	24.6
44	Synthetic and man made fibres	24.7
45	Rubber processing	25.1
46	Plastic processing	25.2
47	Glass and glassware	26.1
48	Processing of refractory ceramics (excluding building items)	26.2
49	Ceramic boards and flags	26.3
50	Brick, tile and other building material processing	26.4
51	Cement, lime and plaster	26.5
52	Processing of concrete, cement and lime items	26.6

55	Metallurgy and ferroalloys processing	27.1
56	Manufacture of tubes	27.2
57	Other metallurgy products	27.3
58	Precious metals and other non-ferrous metals	27.4
59	Foundry	27.5
60	Metal structures and products	28
61	Manufacture of equipment for producing and using of mechanical power (except for plane engines, vehicles and motorcycles)	29.1
62	Machinery for general use	29.2
63	Agricultural and forestry machinery	29.3
64	Machine tools	29.4
65	Other machines for special use	29.5
67	Labour-saving devices and domestic machinery	29.7
68	Computers and office means	30
69	Electric machinery and appliances	31
70	Radio, TV-sets and communication equipment and apparatus	32
71	Medical, precision, optical, watchmaking instruments and apparatus	33
72	Means of road transport	34
73	Naval engineering and repair	35.1
74	Production and repair of railway transport means and rolling equipment	35.2
75	Aircraft engineering and repair	35.3
76	Motorcycles , bicycles and other transport means	35.4 ; 35.5
77	Furniture	36.1
78	Other industrial activities	36.2 - 36.6
79	Electric power production and distribution	40.1
80	Gas production and distribution	40.2
81	Production and distribution of thermal energy	40.3
82	Water collection, treatment and distribution	41
83	Construction	45
84	Wholesale and retail	50 – 52
85	Hotels	55.1 ; 55.2
86	Restaurants	55.3 – 55.5
87	Railway transport	60.1
88	Road transport	60.2
89	Pipe-line transport	60.3
90	Water transport	61
91	Air transport	62
92	Auxiliary transport activities and travel agencies	63.1 ; 63.2
93	Tourism agencies and assistance	63.3
94	Post and mail	64.1
95	Telecommunication	64.2
96	Financial, banking and insurance services	65 – 67
97	Real estate activities	70
98	Computer and related activities	72
99	Research and development	73
100	Architecture, engineering and other technical services	74.2
101	Other business activities	71 ; 74.1 ; 74.3 – 74.8
102	Public administration and defence, compulsory social assistance	75
103	Education	80